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Forthcoming Events.

MARCH 2.

Institute of Metals (North-East Coast Local Section):—Ordinary meeting at Newcastle-on-Tyne. "Bearing Metals," Paper by R. T. Rolfe, F.I.C.

Institute of Metals (Birmingham Local Section):—Ordinary meeting at Birmingham. "Light Alloys," Paper by L. Aitchison, D.Met.

Grantham and District Association of Engineers:—Ordinary meeting. "Comparisons in Foundry Methods and Processes," Paper by E. Longden.

MARCH 10.

Institute of Metals:—Annual dinner at Trocadero Restaurant, London.

Institute of Metals:—Annual general meeting in London.

Institute of British Foundrymen.

MARCH 6.

Scottish Branch:—Ordinary meeting at Glasgow. "Steel Castings," Paper by A. McCance, D.Sc.

Falkirk and District Branch:—Ordinary meeting at Paisley. "Improved Methods of Microscopy for Metallurgical and Works' Practice," Paper by F. Davidson.

Lancashire Branch:—Ordinary meeting at Manchester. "Aluminium Foundry Practice," Paper by G. Mortimer.

Wales and Monmouth Branch:—Ordinary meeting at Cardiff. "Metals used in Brass Foundries," Paper by C. A. Howe.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.
PRESIDENT, 1925-26: John Cameron, Kirkintilloch, near Glasgow.

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Wales and Monmouth Branch: J. J. McClelland, M.I.Mech.E., Druslyn, Bishops Road, Whitechurch, Glam.

Welsh Engineers' and Founders' Association.
Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

Foundry Trades Equipment & Supplies Association.
Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

Extending Technical Knowledge.

Since last Saturday, when we took part in a meeting at Middlesbrough, held for the object of interesting local foundrymen in the work of the Institute of British Foundrymen, we have been wondering whether sufficient effort has been put forward to interest those foundry owners, managers, foremen, and artisans in districts other than where branches have been established. The spontaneous response made by the Tees-side foundrymen went beyond the most sanguine expectations, and, undoubtedly, the speakers were actuated by the highest ideals, and realised that no sane body of foundrymen could help but appreciate that a branch of the Institute is a definite acquisition to any district. It provides an organisation which carries with it a voice in the conduct of the world's foundry technique. Thus the task of forming branches in large foundry areas is comparatively easy, whilst their efficient conduct and usefulness is largely a matter of local organisation. But what about the large number of foundries scattered over Ireland, the area stretching from Brighton to Land's End, East Anglia, Holderness, and other large territories? It must on no account be assumed because no branch is reasonably available, that they are not interested in the technical progress of the industry. Obviously, the question arises, does the Institute make conditions sufficiently interesting for unattached members? We believe the best answer to this question is a reference to the foreign membership list. Thus, if foundrymen in Australia, Canada, South Africa, India, Spain, France, Belgium, Italy, United States of America, think it is worth while, surely founders in places like Hull, Barrow, Brighton, Yeovil and Belfast might usefully pose to themselves the question: "Why do the Dominion and foreign foundrymen join the Institute?" The Dominion and foreign members can obtain but a minimum of the advantages, but an unattached member possesses the advantage of the Annual Conferences, and receives invitations to participate in many of the foreign conventions also. Additionally, we feel sure that if sufficient unattached members decide to interest themselves in the welfare of the Institute, its Council would give the most careful consideration to the holding of two general meetings each year for their special benefit.

We are constantly receiving requests for information as to the steps to be taken for joining, sometimes anonymous, asking us to reply through the Press, whilst only this week a founder living on the outskirts of Manchester made a similar request. We would draw attention to the fact that in the column next to this we invariably print a list of the addresses of the branch secretaries, as well as that of the general secretary. Whilst we are only too pleased at all times to help inquirers, we can assure them that these officers are provided with all the necessary data for placing at the disposal of applicants.

The Middlesbrough Propaganda Meeting.

A Teesside branch of the Institute of British Foundrymen was inaugurated at a meeting held in the Cleveland Technical Institute last Saturday night. Mr. H. B. Toy, managing director of the British Chilled Roll and Engineering Company, Limited, Haverton Hill, and a member of the Council of the Iron and Steel Institute, presided. He was supported on the platform by Mr. John Cameron, J.P., the President of the Institute; Mr. R. O. Patterson, a Past-President; Mr. V. C. Faulkner, senior Vice-President; and Mr. Colin Gresty, the Honorary Secretary of the Newcastle Branch.

Well over one hundred people connected with the local foundry industries were present, and at the conclusion over fifty nomination forms were signed and handed in.

The Chairman, in his opening remarks, referred to the number of local societies which already existed on Teesside, but pointed out that none was catering specially for those interested in foundry practice. There were at least 40 foundries in the district which possessed no local medium for the presentation and exchange of technical knowledge. The requirements exacted from the industry to-day were vastly different from those which existed twenty years ago. Foundrymen now received specifications which were difficult to fulfil. Yet they had locally no organisation to protest if these became too onerous. It was obvious that the ironfounding was just as important as the manufacture of structural steel. He was convinced that there was a definite need for the establishment of a branch of the Institute locally.

MR. JOHN CAMERON, the President, gave details of the work of the Institute, referring specially to the democratic character of its membership, which included anybody interested in foundry practice, from the managing director down to the most recently recruited apprentice. He touched upon the benefit to be derived from the participation in discussions, and emphasised the value to be obtained from attendance at the annual congresses.

MR. R. O. PATTERSON dealt with the work of the branches, and pointed out that no fewer than 120 papers were being presented during the present session. He instanced a case of a foundry owner who, being in trouble, consulted him. He (Mr. Patterson) learnt that the mixture used contained a certain amount of scrap to cheapen it, some hematite to harden it, some Scotch iron to soften it, and so on. The trouble was overcome with a much cheaper mixture, which was now regularly chemically controlled, whilst the inquirer was now a prominent member of the Institute. He personally had also received much help from his association with the Institute.

MR. V. C. FAULKNER said that when a student he was taught that bad cast iron withstood a tensile test of 8 tons per sq. in., medium should break at 10, whilst good should register 12 tons. To-day some foundries regularly make iron breaking at 18 tons, whilst one iron had actually been returned at 26.9 tons. This wonderful progress was due largely to the work of the Institute. Dealing more particularly with the International aspect, Mr. Faulkner pointed out that every day of the year there was yet a further paper presented on some aspect of foundry practice. Could Middlesbrough, one of the most important ironfoundry centres in the world, be content to remain voiceless? It was patent that the Institute was the recognised authority, not merely nationally but internationally, for the expression of opinion on all things appertaining to the technical side of foundry work. If Middlesbrough desired to influence national thought, the Institute was the only channel through which they could operate.

A general discussion from the body of the hall followed. It was opened by MR. F. P. WILSON, of Messrs. Pease & Partners, who pointed out that as a member of the Newcastle Branch he had failed to obtain the maximum benefits owing to unsuitable railway facilities. He was followed by MR. HOLMES, of Birtley, who appealed to the blast-furnace people to associate themselves with the Institute, as their technical knowledge was largely complementary. A number of questions appertaining to advantages and rights of various grades of membership were answered by Mr. Gresty.

MR. S. V. TOY, a member of the London Branch, then proposed that the necessary steps be taken in accordance with the by-laws to form a branch of the Institute of British Foundrymen in Middlesbrough, and said that he had had, as a joint promoter of the scheme with Mr. N. D. Ridsdale, every possible help given him by the officials of the Institute, especially Mr. Gresty. He had been impressed with their enthusiasm, and was convinced that Middlesbrough foundrymen would benefit by associating themselves with this body.

MR. N. D. RIDSDALE expressed the satisfaction of the promoters at the excellent response which had been made to their appeal, and hoped the majority would see their way clear to support the proposed branch.

THE CHAIRMAN then put the resolution to the meeting. It was carried unanimously and with a good deal of enthusiasm.

A temporary committee was formed to carry out the resolution, with Mr. F. P. Wilson as Chairman and Mr. S. V. Toy and Mr. N. D. Ridsdale as joint Secretaries. After the application forms had been collected it was found that the Branch would start with a numerical strength of about 60, including transfers from other branches.

The meeting closed with votes of thanks to the officers of the Institute who had travelled from a distance to help, to the Director and Council of the Cleveland Technical Institute, and to the Chairman for presiding.

Core Oil Factory Extension.

The constantly increasing demand for Spermolin specialities has compelled Messrs. Spermolin, Limited, to acquire very much larger premises in Union Street South, Halifax, and they are now installed in their new works.

Spermolin, Limited, were the pioneers of the core oil industry in this country, having been established since 1908, and the continued expansion of their business testifies to both the uniformity and the excellence of their products.

The postal and telegraphic address remains as before—Black Swan Works, Halifax.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

The "Shell" Defect in Ingot Moulds.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The article under the above heading in the issue of February 4 was very interesting reading and brought up many puzzling reminiscences of a good few years ago, when I was in charge of a foundry in a northern area where ingot moulds up to 40 tons were produced.

Ingot moulds and thin moulding were to me a new experience, and when similar circumstances arose as described, the problem was a phenomenon. Various methods similar to those stated were adopted for the heavy cores, which were either of sand or loam, rammed up or built up round an internal casing. As stated, the first conclusion was that it was the blacking that was at fault, and I endeavoured to alter this by painting with silicate of soda, and also by face-spraying.

Being run on one side at the bottom, and also dropped in from the top, the idea then came along that probably it was the surging of the metal round the corners, this wave running up and like cream on a milk can, stuck there and never remelted. This seemed feasible, but what about the shell being blacked on both sides? The iron used was all hematite (local), *none other ever being used for ingots.*

I ultimately came to the conclusion that it was a metallic substance oozing out from the mass in some way. Possibly it was phosphorus.

The author says "Its cure *should* be effected by iron of a short freezing range." Has this entirely overcome the difficulty, and how would he have fared if confined to the use of local hematites entirely?—Yours, etc.,

INTERESTED.

Sand Blasting and Other Aids to Fettling.*

By F. W. Neville, B.Sc. (Eng.).

Sand blasting is the term generally used to describe a process for cleaning castings, stampings, and other metallic objects, which consists essentially of the projection of an abrasive at high velocity on to the object to be cleaned.

The abrasive may be sand, steel grit, or steel shot of various grades; and the high velocity is obtained by discharging the abrasive with air under pressure through a nozzle.

A typical general purpose plant consists of a chamber, the floor of which is gridded, so that abrasive, tailings, etc., fall through and slide down the sloping foundations to a worm conveyor, thence to be carried to a bucket elevator, from which they are discharged over a cleaning device. The tailings are collected separately, while the clean abrasive is delivered to the abrasive container to which the sand-blast nozzle is connected. From the top of the chamber, dust exhaust pipes lead through a dust separator to a fan; the fan discharge being made to atmosphere via a water tank, where the very fine dust is removed. Whenever possible the operator works from outside the chamber, the nozzle projecting into it, through, say, a rubber curtain or opening in sliding door. There are three systems of sand blast in general use—the pressure, the suction and the gravity feed.

The Pressure System.

In this system the abrasive is contained in a closed pressure chamber, to which is fed pressure-air, and from which a mixture of air and abrasive passes through a control valve into a pipe line in which pressure-air is flowing: the whole being discharged through a nozzle at the end of the pipe.

The simplest sand-blast unit for this system consists of the pressure chamber, below which is the control valve, and above which is an abrasive hopper. There is a hand-operated valve between the abrasive hopper and the pressure chamber. When the pressure chamber has been emptied of abrasive, air must be shut off to allow the chamber to be refilled from the hopper. Thus, continuous blasting-time is limited by the size of the pressure chamber. For many purposes, this fact, and the fact that time is needed to refill the pressure chamber are not disadvantageous—as for instance when the plant is applied to a tumbling barrel—providing a batch of castings is cleaned before the pressure chamber empties. This may be called a non-continuous plant.

In cases where continuous blasting is required, this can be obtained by providing a pressure chamber intermediate between the first chamber and the hopper. Thus, blasting can be taking place from the lower chamber, while the middle chamber is being filled from the hopper, by closing the valve between the two chambers. When the valve between hopper and middle chamber is closed, and the other open, abrasive is being collected in the hopper, and is also falling from middle to lower chamber, blasting proceeding meanwhile.

The plant can be arranged so that one movement of a single lever operates all the valves as required; and such a plant may be termed continuous working. The sand control-valve works under very bad conditions, and moving parts should so far as is possible be protected from the abrasive. It should be easy to inspect all valves, and air supply pipes should be generous in size.

The Suction System.

In this system the discharge unit consists of a discharge nozzle projecting from one end of a mixing chamber, into the other end of which is fitted an air nipple. A suction pipe leads from atmosphere past the sand control-valve to the side of the mixing chamber—the sand control-valve communicating with the sand-bin.

Pressure air is fed by a separate pipe direct to the air nipple, discharged into the mixing chamber, there depressing the pressure below atmosphere, with the consequence that air from the open end flows along the suction pipe, picks up the abrasive material, and carries it to the mixing chamber. There, pressure air, suction air and abrasive are mixed, and finally expelled through the discharge nozzle. The abrasive is collected and returned to the sand-bin. This system is therefore automatically continuous working.

Gravity Feed System.

This approximates to the suction system, the chief difference being that the abrasive is fed to a mixing chamber under the influence of gravity, additionally to any suction effect.

EFFECT OF VARIOUS FACTORS ON THE WORKING OF A PLANT.

A knowledge of the effect of changing various factors, such as the abrasive, air pressure, etc., is useful, if the optimum efficiency is to be obtained from any of the above systems.

(1) RELATION BETWEEN ABRASION RATE AND FLOW RATE.

In this paper the rate at which material can be removed by blasting is called abrasion rate, and the rate at which abrasive flows through the nozzle—flow rate, in lbs. or grammes per minute as the case may be.

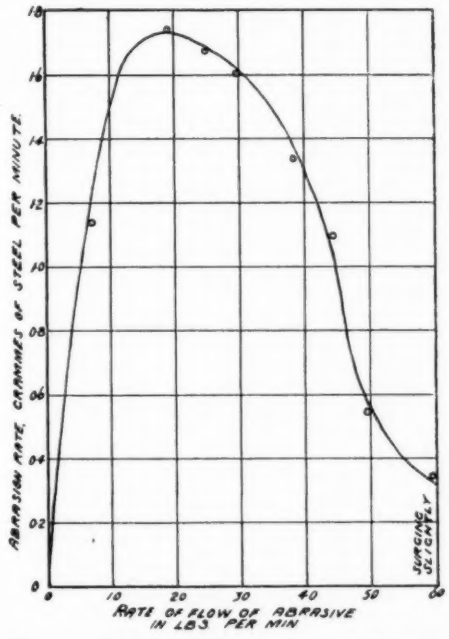

FIG. 1.—SHOWING RELATION BETWEEN FLOW RATE AND ABRASION RATE.

If the amount of abrasive flowing is gradually increased by opening the control valve, a condition will be reached where the abrasive does not leave the nozzle steadily, but comes out in jerks—in fact surging occurs.

Using a pressure plant under standardised conditions, with stationary nozzle perpendicular to the test piece, an air pressure of 15 lbs. per sq. in., nozzle diameter $\frac{1}{2}$ in., and using No. 24 steel grit, measurements of (*a*) air consumption, (*b*) flow rate in lbs. per minute, and (*c*) abrasion rate from a C.R.C.A. plate in grammes per minute were made, and the results have been plotted.

The relation between flow rate and abrasion rate is shown in Fig. 1. It will be seen that the rate of abrasion increases as the flow rate is increased, until about 20 lbs. per minute of steel grit is flow-

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* A Paper read before the Falkirk Section of the Institute of British Foundrymen. The author is on the staff of J. W. Jackman & Co., Ltd.

ing. Thereafter it decreases. Slight surging is not evident until 60 lbs. of abrasive is flowing per minute. Over a range of flow of from 10 to 35 lbs. per minute the abrasion rate does not change much.

(2) RELATION BETWEEN FLOW RATE AND BLASTING EFFICIENCY.

From the figures obtained above for air consumption the horse power required to keep the plant running under the various conditions has been computed. By dividing the abrasion rate by the horse power, a factor is obtained which enables us to compare what the author calls the blasting efficiency, i.e., abrasion rate per horse power, for different flow rates. These results are plotted in Fig. 2. and it will be seen in this case again that maximum efficiency is obtained considerably before surging point is reached.

It will be seen that maximum blasting efficiency is obtained when about 28 lbs. of abrasive flows per minute. Maximum rate of abrasion occurred with a 20 lbs. per minute flow. From 20 lbs. per minute to 28 lbs. per minute flow the abrasion rate decreases, but the blasting efficiency increases. This is because the air consumption is reduced.

In practice, therefore, one should *not* pass the maximum quantity of abrasive through the nozzle. About half the maximum will give much better

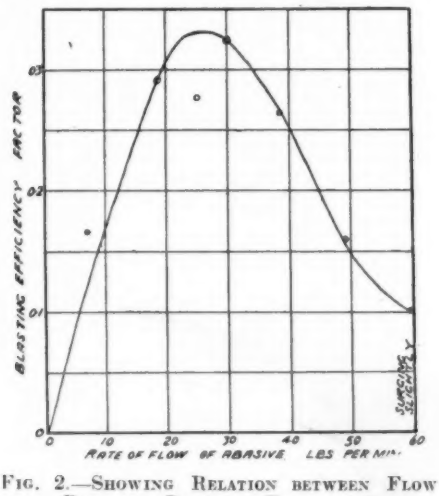


FIG. 2.—SHOWING RELATION BETWEEN FLOW RATE AND BLASTING EFFICIENCY.

results, both as regards speed of cleaning and efficiency.

(3) EFFECT OF AIR PRESSURE ON ABRASION RATE.

This test was made under conditions as previously described, but at various air pressures. Results at each pressure are for maximum efficiency as regards flow rate.

The results have been plotted in Fig. 3, and the curve shows that abrasion rate increases with air pressure, and more than proportionally. Thus, *in practice*, to clean rapidly, increase the pressure, but there is a point to be noticed here as regards the test, which shows the rate at which material is removed from a steel plate. In practice the amount of material removed does not matter, so long as scale, adherent sand, etc., is removed. And it may easily occur that, at, say, 15 lbs. per sq. in., a casting is being cleaned as quickly as nozzle control permits. If that be the case it would be foolish to push up the pressure—for the only effect would be to dig rather more deeply under the skin.

(4) EFFECT OF AIR PRESSURE ON BLASTING EFFICIENCY.

Taking the results of the previous test, and dividing the abrasion rate by the horse power used in compressing the air to the various pressures, there is obtained, as before, a blasting efficiency factor. The curve drawn in Fig. 4 from these results shows that blasting efficiency is approximately constant at various pressures.

Thus, if other conditions permit, in a foundry, and work could conveniently be done at a greater rate, then increase the air pressure to obtain greater rate of cleaning without loss of efficiency.

It may be noted here, that blasting efficiency is only one factor in the all-important overall commercial efficiency. To obtain this latter capital expenditure and many other matters have to be considered. But conditions are so various that it is impossible to attempt a solution in this Paper.

(5) EFFECT OF ANGLE OF IMPACT ON ABRASION RATE.

The angle between the axis of the nozzle and the surface of the article cleaned is called the angle of impact. Working under conditions as outlined for experiment 1, as to pressure, etc., but with various abrasives and materials, abrasion rates were measured for various angles of impact (abrasive flow rate being arbitrarily chosen in each case). The results are plotted in Fig. 5.

Using 24 Angular Steel Grit.

(*a*) *On C.R.C.A. plate*, the less the angle of impact the greater the abrasion rate—the latter being 3.55 grammes per min. at 30 deg. and only 1.65 grammes per min. at 90 deg., *i.e.*, more than twice as much.

(*b*) *On Grey Cast Iron.*—In this case the abrasion rate increases as the angle of impact is decreased from 90 deg. to 50 deg., but thereafter decreases.

Using 24 Round Steel Shot.

(*a*) *On Grey Cast Iron.*—Again it was found that the abrasion rate increases as the angle of impact is decreased from 90 deg. to 60 deg., but then decreases.

Thus in practice, the nozzle should be held obliquely to the work—say, at about 45 deg.—and not perpendicularly to it.

(6) EFFECT OF DISTANCE BETWEEN NOZZLE TIP AND ARTICLE TO BE BLASTED.

Working under the standard conditions Fig. 6 shows that from 8 in. to 16 in. distance between nozzle tip and work there is very little change in the abrasion rate. Bringing the nozzle closer

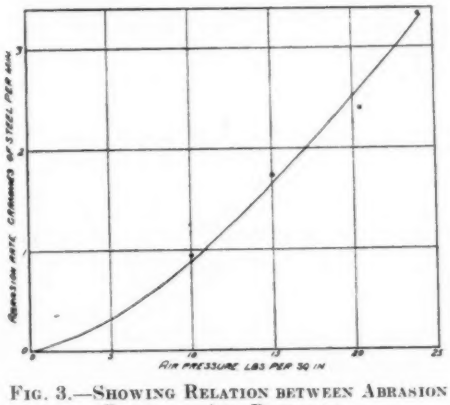


FIG. 3.—SHOWING RELATION BETWEEN ABRASION RATE AND AIR PRESSURE.

than 8 in. to the work results in a rapid slowing up of abrasion rate. This, however, only occurs appreciably with a stationary nozzle. If the latter is moved about over the work, the abrasion rate remains approximately constant. Hence under working conditions roughly the same amount of material is removed per minute, irrespective of the distance between nozzle and work. But the cleaned area increases with increasing distance, the cleaning not being so intense when the area is large. The position of the nozzle relative to the work, for greatest efficiency depends therefore on the nature of the work. If the article is cleaned with difficulty, the nozzle should be close to the work. If with ease, the nozzle can be further from the job, and the abrasive be allowed to spread.

(7) LIFE OF ABRASIVE.

At each impact a certain percentage of abrasive is pulverised and is taken away as dust to the fan. Sand is very quickly pulverised, and in consequence a large amount of dust is generated.

Thus, of 43 lbs. of Leighton Buzzard sand, the weights collected after successive impacts at 15 lbs. per sq. in. on steel, were 37, 32, 29 and 25 lbs., *i.e.*, in four impacts, 41 per cent. of the original sand had disappeared to fan as dust—the up-current of air moving at about 160 ft. per min. Of the remaining 25 lbs., 18 lbs. would pass a 32 mesh sieve, and 6¾ lbs. a 25 mesh sieve. The original sand would not pass a 32 mesh. Despite the rapidity with which it is broken, sand is still used—giving in some cases a desirable finish and being cheap in first cost.

A No. 24 steel grit was tested, and from 30 lbs. it was possible to recover 29 lbs. after ten impacts, at 15 lbs. per sq. in., *i.e.*, one-third of 1 per cent. disappears per impact. Despite its comparatively high initial cost, it is probably cheaper than sand in the long run. The dust nuisance is much less and the steel is the more efficient abrasive. In practice with a steel abrasive, it is probable that more loss occurs due to imperfect reclamation than to pulverisation.

(8) EFFECT OF CHANGE OF ABRASIVE ON ABRASION RATE AND BLASTING EFFICIENCY.

Pressure System.—Conditions of the test were as for test 1 with regulating valve set to give various flow rates. The greatest abrasion rates for four steel abrasives working on steel and two abrasives working on cast iron are shown in Fig. 7. It will be seen that the angular abrasives clean very much more quickly than do the round abrasives—particularly when working on steel—and that the larger abrasives clean somewhat more quickly than the smaller.

Fig. 8 shows that roughly the same thing may be said as regards maximum blasting efficiency. At maximum abrasion rates there is a slight saving in air consumption when using the smaller abrasives. In practice, therefore, it pays to use an angular steel grit. A fine grit, while being

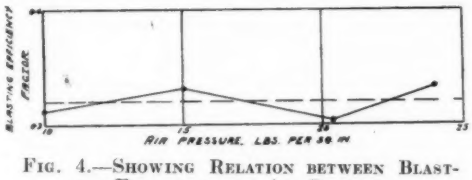


FIG. 4.—SHOWING RELATION BETWEEN BLASTING EFFICIENCY AND AIR PRESSURE.

slightly less efficient, gives a much nicer finish. Results for sand have not been plotted—chiefly because the abrasive varies so much. Speaking roughly, it can be said that using new Leighton Buzzard sand, results are obtained intermediate between those obtaining for steel shot and grit.

Suction System.—In this system the air consumption is practically constant, whatever the abrasive used, since pressure air is always discharged into the mixing chamber, through an air nipple which is not reduced in effective area by abrasive.

Results show that a coarse steel grit is the most efficient abrasive, and in general results as regards abrasives are roughly as with the pressure system.

(9) EFFECT OF WEAR ON NOZZLES.

Pressure System.—As the nozzle wears to a greater diameter, one of two things will happen: (*a*) If the plant is taking all the available pressure air with a new and therefore small nozzle, then the pressure will drop as the nozzle wears, with consequent decrease in power consumed, but with an approximately similar decrease in abrasion rate. (*b*) If the compressor is sufficiently big to keep up the pressure, then more air is being taken as the nozzle wears, with consequent increase of power consumption; and since the blasting efficiency will remain approximately constant, the abrasion rate will increase with the increased power consumption. That is, if, as the nozzle wears, the pressure drops, cleaning will probably be slower: while if the pressure remains steady, cleaning will probably be quicker. In either case it will be advisable to regulate the sand control valves to get maximum efficiency.

Suction System.—As previously stated, the air regulating nozzle does not wear. Consequently receiver air pressure and power consumption remain constant. The discharge nozzle wears however, with consequent slight alteration of conditions in the mixing chamber, but generally it is not necessary to regulate the sand control valve. The blasting efficiency and abrasion rate do not change appreciably over the practical range of wear in a well-designed plant.

Nozzles are usually made of a hard cast iron, but gas piping is not infrequently used.

(10) FINISH OBTAINED ON CAST IRON CASTINGS

Roughly, it may be said that the finish obtained on a sample of cast iron cleaned under standard conditions, but using different abrasives, is with (1) Fine steel grit, a bright silver grey; (2) coarse steel grit, a bright silver grey, but coarse finish; (3) fine steel shot, dull, but fine finish; (4) coarse steel shot, dull and coarse finish; and (5) sand, not quite so bright as with fine steel grit.

The notes so far given have dealt with the working of the sand-blast unit itself. The pres-

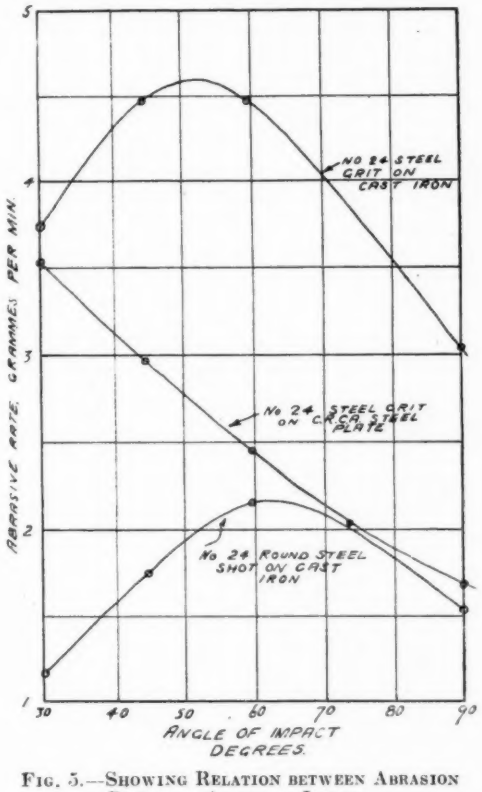

ABRASIVE RATE. GRAMMES PER MIN.
No 24 STEEL GRIT ON CAST IRON
No 24 STEEL GRIT ON C.R.C.A. STEEL PLATE
No 24 ROUND STEEL SHOT ON CAST IRON
ANGLE OF IMPACT DEGREES.

FIG. 5.—SHOWING RELATION BETWEEN ABRASION RATE AND ANGLE OF IMPACT.

sure air fed to the unit should be dry, or there will be a tendency for the abrasive to clog at the valves. If a large receiver or if a long pipe line is in use, the air is usually cooled sufficiently to condense the moisture which must be trapped.

In any case it is wise when shutting down a plant at the end of a day to close off the sand regulating valve and clear the hose by blowing through pressure air. It will be of interest now to consider a few complete sand blast plants, illustrating some of the applications of the process.

Chambers.

These are general purpose plants. In general they are used for cleaning the larger articles—such as locomotive cylinders, baths or a steel side-car frame. They are built to suit any set of conditions. Thus for heavy work, a runway may be provided. Usually one side at least consists of a vertically sliding door, the weight of which is balanced. A separate compartment may be provided for the operator separated from the actual chamber by a horizontally sliding door, in which case he is protected from much of the rebounding abrasives, while the fan suction creates a fairly high air velocity through the narrow opening of the doors and so keeps him

more free from dust. But he should be provided with helmet and gloves. With a power-driven grid turntable in the chamber, controlled by a foot clutch in the operator's compartment, work placed on the table can be brought within range of the nozzle. With much large work, however, it is necessary for the operator to be inside the chamber, in which case also he must be provided with protective helmet and gloves.

For work such as, say, gas cookers, a small chamber may be built, with a vertically sliding door, provided with a window through which the work can be viewed, and a split rubber curtain through which the nozzle is controlled.

Chambers can be used in conjunction with either the pressure or the suction system. The abrasive may be collected mechanically as already described, or it may be collected pneumatically. In the latter case, the abrasive, etc., falls down the sloping foundation into a pipe through which air is being sucked by a fan. This air carries the abrasive, tailings, etc., to a separator from which clean abrasive is delivered to the container.

A vacuum of 4 in. of water is sufficient to elevate the shot to the separator, and the air of the chamber should be cleared at least four times a minute. It is perhaps better to specify that the mean vertical velocity of suction air reckoned over the full floor area should be at least 40 ft. per min. per sq. ft. of area.

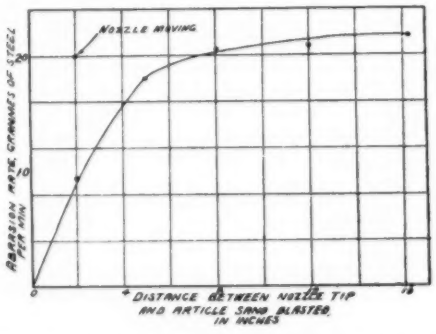


FIG. 6.—SHOWING RELATION BETWEEN ABRASION RATE AND DISTANCE BETWEEN NOZZLE TIP AND ARTICLE SAND-BLASTED.

Cabinets.

A cabinet is generally used for smaller work than a chamber, and as a rule its working level is above ground. The nozzle may be fixed, in which case the operator stands or sits outside, puts his hands, which are protected by guantlets or rubber gloves, through arm holes and passes the work as required, under the nozzle discharge. He sees the work through a window. Entrance to the cabinet is through a swinging door which frequently carries the arm holes and window. The fixed nozzle type is suitable only for light work. Control of the operation, *i.e.*, starting and stopping blasting, etc., should preferably be by single lever, operated from the working position.

With a portable nozzle, larger work may be handled—a runway being provided if necessary—and the nozzle may be either connected by flexible hose to a junction inside the cabinet or a longer hose may be taken through split rubber curtains or through the armholes. Ease of handling both nozzle and casting is important. The abrasive, etc., fall through a grid on to a sieve, below which cleaned abrasive is collected ready for re-use. Both suction and direct pressure may be used, and in either case the plant is generally placed immediately below the sieve and above ground level. Dust is usually sucked away from the top of the chamber.

A cabinet plant is again a general-purpose plant within the limits of its size. The collection of abrasive is automatic, the plant is simple and compact. The operator stands outside the cabinet, from which no dust can escape.

Lighting of both cabinets and chambers may be daylight through glass sides and top, or electric light through a glass top. The electric light is sometimes inside. Care must then be taken of the bulbs.

Sand Blast Tumbling Barrels.

These consist essentially of a closed barrel, through the one or both ends of which projects a sand blast nozzle. The barrel is supported on and driven by rollers.

In one form the barrel, rollers, etc., are enclosed in a casing provided with a sliding door, dust being sucked from the top or bottom of the casing, while the abrasive, after being discharged on to the contents of the barrel, falls through perforations in the latter and slides down a chute to be collected pneumatically or mechanically as the case may be. The perforated barrel is provided with a door usually on the cylindrical surface, through which the barrel is charged.

In another form the nozzle projects through the end as before, but the perforated barrel is surrounded by a solid taper barrel which collects the abrasive, conveys it to one end, where it is collected in an annular passage, and delivered from there to a hollow trunnion. From this point it may be delivered over enclosed screens to the sand-blast plant ready for re-use, connection to the fan being made from the delivery end of the machine. These machines may be worked with either pressure or suction system. For barrels, small compact work is the usual run, but long drop stampings can be cleaned, and even long and somewhat delicate textile castings have been successfully treated. Malleable iron in the hard condition can be barrelled without cracks developing later. Brass valves and cocks are cleaned, the cores being removed in the process. Sand-blast barrels do not rattle castings so drastically as do tumbling barrels.

Rotary Table Machines.

A machine typical of these consists of a gridded table rotating under power, half of the table always being inside a casing, through the top of which project the nozzles. The front of the casing usually consists of a split-rubber curtain, which runs diametrically across the table. In operation the castings to be cleaned are placed on the front, *i.e.*, open half of the table. This rotates, and the castings are carried into the casing and are subjected to sand blasting.

The nozzles rotate about an axis eccentric and inclined to their own axis, and by suitably proportioning their speed and the speed of the table approximately uniform cleaning can be obtained. Spent abrasive is collected and delivered to an elevator at the back of the machine, from where it is delivered to a container ready for re-use. The cleaned castings are brought out through the curtain by the rotating table, and can be removed by the operator or allowed to go round again if they are not completely cleaned. Gravity feed nozzles can be conveniently used on this plant, as rotation of the nozzles can be easily arranged; but direct-pressure and suction plants are made. Fairly open work is in general most suitable, such as stove fronts, gear wheels, pulleys, etc. Other special-purpose machines are made, but are not in great demand.

Dust Extraction and Separation.

Recently Home Office regulations have come into force with regard to sand blasting. These may be summarised as follow:—(1) Sand blasting shall be done only in an enclosed chamber used for no other work, and provided with means to prevent the escape of dust from the chamber; (2) no person shall be allowed to work in a chamber, or within 30 ft. of a sand-blast nozzle in the open air, while sand blasting is in progress without being suitably protected by helmet, gloves, etc.; (3) all persons working within the above limits must be provided with suitable protective devices; and (4) all ventilating plant used must be tested completely once every six months.

With regard to the plants described, the operator must be protected as described above when working inside a chamber, but with chambers, cabinets, barrels and rotary tables where the operator works outside, no helmet is necessary, so long as dust is prevented from getting outside the plant. This condition is obtained as described by connecting the plant by pipes from 4 to 20 in. dia. to a fan.

With cabinets, etc., it is necessary that doors be a good fit. Where possible, it is, in fact, pre-

ferable to make these seal, and rely for air admission on special ports protected to prevent rebound sand escaping.

The suction head will vary with conditions. The essential thing is that the air velocity at any port open to atmosphere shall be sufficient to keep dust from escaping. With properly designed ports and ducts, 3 in. of water at the fan will probably be adequate.

The dust sucked away from the plant must not be discharged direct to atmosphere. Usually a separator is placed between plant and fan. This may be of the cyclone type, which consists essentially of a cylinder closed at the top, provided with an inner cylindrical baffle and contained by a cone at the bottom. Air enters at the periphery near the top, and dust, etc., falls to the bottom, the cleaned air being taken away from the top. Very fine dust settles in a water tank.

In a different type the air is forced to take a spiral path inside a cylinder which has a number of fine longitudinal slots in it. The dust passes through these slots owing to contrifugal action, and is collected in an outer casing, while the air is drawn away through a central tube to the fan.

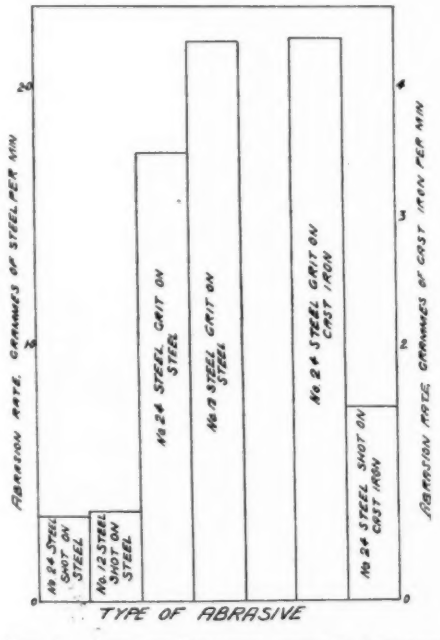

ABRASION RATE. GRAMMES OF STEEL PER MIN
ABRASION RATE. GRAMMES OF CAST IRON PER MIN
No 24 STEEL SHOT ON STEEL
No 12 STEEL SHOT ON STEEL
No 24 STEEL GRIT ON STEEL
No 12 STEEL GRIT ON STEEL
No 24 STEEL GRIT ON CAST IRON
No 24 STEEL SHOT ON CAST IRON
TYPE OF ABRASIVE

FIG. 7.—SHOWING RELATION BETWEEN ABRASION RATE AND TYPE OF ABRASIVE.

The final discharge from this, as previously mentioned, is made *via* a water tank.

It is not easy to rid the air completely of all very fine dust, but the above plant gives good practical results. If the final discharge can be made into a high and large chimney, this is perhaps as effective as anything.

Protection of Operator.

For work in the chamber the operator must be provided with helmet and gloves, and overalls or an apron. Helmets may be made of leather, or an aluminium spinning may be used. A renewable window is provided, and air is fed through an adjustable valve to a distributor at the top by means of a rubber pipe. Expired breath escapes *via* the neck band. The pressure on the helmet being slightly greater than atmospheric, dust cannot reach the operator. The gloves are leather, and are armoured, or may be made of rubber. These are used also for work in a cabinet.

Other Aids to Fettling.

As regards the removal of scale, adherent sand, etc., sand blasting provides an efficient means and gives a good finish. There are other means available for removing sand. Castings may be hand-brushed, and with a certain class of work, where the area is large, the surface smooth, and the sand lightly attached—where, in fact, the sand may be blown off—it is questionable whether sand blasting affords a sufficiently great economy in time to pay for the necessary plant—unless it is desirable to get to virgin metal.

Core Remover.

A little instrument which was exhibited at the Düsseldorf Exhibition might prove useful for removing cores. It consists of a flexible spindle which is caused to vibrate by being continously tapped by a vibrator. The article is placed over it while the spindle is vibrating, and this removes the core. The spindle may be shaped. Both of these operations may be performed on a gridded table cased in below to collect chippings, etc., while the dust is drawn away by a fan through a pipe running the full length of the table. Such a table may be built at floor level, a pit being made as collector.

Tumbling Barrels.

Barrels may be used without sand blasting. They may be round, hexagonal or square in sec-

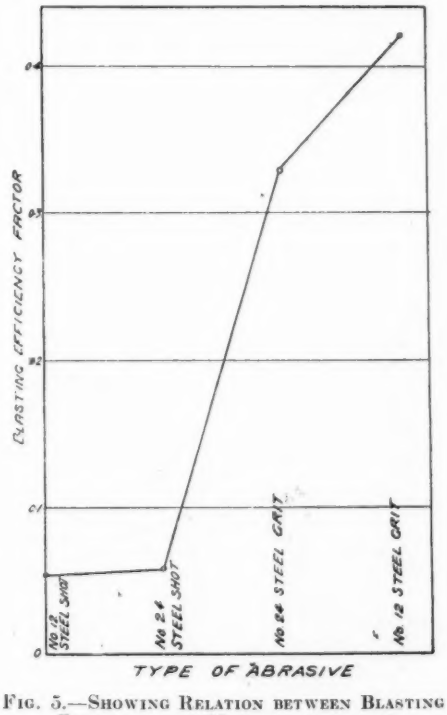


FIG. 5.—SHOWING RELATION BETWEEN BLASTING EFFICIENCY AND TYPE OF ABRASIVE.

tion, and are built from 1 ft. to 5 ft diameter. Dust may be extracted through a hollow trunnion at one end, or the barrel may be enclosed in a cabinet from which the dust is sucked. Hard iron stars may be loaded with the castings. The finish obtained is quite different from that obtained by sand blasting. The tumbling is generally more severe than in a sand-blast tumbling barrel and goes on for a longer time, with the consequence that edges become more rounded. The surface is, as it were, scraped, but virgin metal is not uniformly exposed. Whereas a charge in a sand-blast barrel might be cleaned in an average time of 15 minutes, the average time for a simple tumbling barrel might be 40 minutes or an hour. Barrels are sometimes packed with leather to reduce shock and possibilities of breakage.

Git Cutters.

These are power machines, usually mechanically operated, and consist essentially of a pair of cutters set in a rigid frame and arranged to exert great pressure in approaching each other.

Grinding Machines.

These are in very general use. Where the castings are comparatively small, stationary grinders are used.

Adequate guarding against the possibility of wheel fracture must be provided, and all dust must be intercepted and removed. This is done by the

provision of a hood connected to a pipe leading to a fan. Again, Home Office Regulations have to be met.

Where large work has to be dealt with swing grinders are used. These consist of a light frame on which is supported an abrasive wheel, usually motor-driven. The frame is pivotally supported, and can swing about vertical and horizontal axes, so that the wheel can be guided over its work.

Conclusion.

All the machines described have their proper uses. Of sand blasting it may be said:—(1) It will remove scale, rust, etc., and it gives a surface which is particularly suitable for painting, enamelling, lacquering, etc. In this connection it has been found that enamel, etc., adheres better than to the non-sand-blasted article, and gives a uniform covering of more pleasing appearance. Less paint, etc., is required to give the requisite film, while if the coating is applied soon after sand blasting it has a longer life, as no oxidation occurs. (2) Fused sand and embedded particles are removed from the skin, with consequent increase in life of tools in the machine shop. In many instances this factor alone makes a sand-blast installation a paying proposition. (3) Dust from cores, etc., can be readily removed without spreading over the foundry; and (4) it is a much less dirty and inconvenient process than pickling, and less costly.

Simple tumbling will do much to remove cores and knock off sand, but it will not give a sand-blast finish. The core remover would be useful for some castings, but is generally slower than barrelling. Pneumatic chippers, git cutters and grinders help to reduce the time of fettling. It is certain that foundries generally are installing more mechanical equipment, and not the least important part of this consists of sand-blast plant.

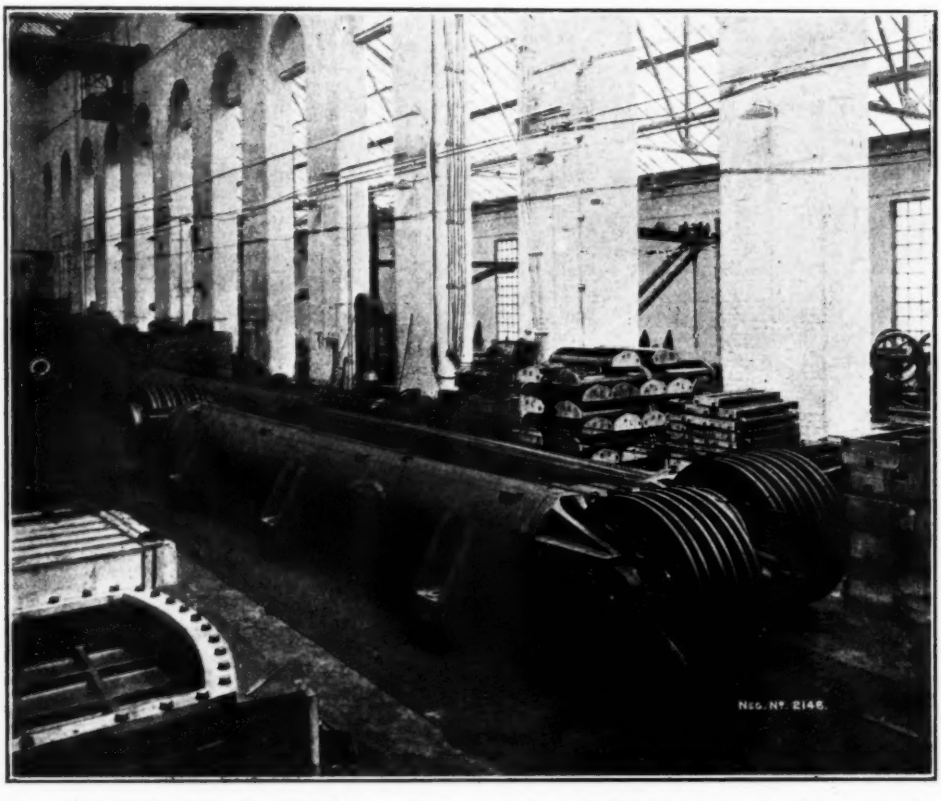
The author desires to express his thanks to J. W. Jackman & Company, for slides and information; and for facilities for making, and permission to publish the results of, the experiments described in this paper, and to The Tilghman Sand Blast Company for certain diagrams and information.

THE LLANELLY COPPER WORKS, established for over one hundred years, are about to close down.

Caisson Hauling Machinery for King George's Dock, Calcutta.

Some time ago there was described and illustrated in these columns a series of four very heavy caisson cylinders, weighing in the rough state over 30 tons each, that were supplied just recently by Glenfield & Kennedy, Limited, of Kilmarnock, Scotland, in connection with King George's Dock, Calcutta, the largest "one-piece" castings ever made in Scotland.

The illustration represents two of these hydraulic cylinders put together temporarily in the shops at Kilmarnock with the rope pulleys on the end, 4 ft. 3 in. diameter, with machined grooves to take steel hawsers of $1\frac{3}{8}$-in. diameter. The ropes shown in the photograph are only for the purpose of illustrating the principle, and the real $1\frac{3}{8}$-in. steel ropes will be fitted on the site, while the cylinder at the back has the ram extended. It may be remembered that these



caisson cylinders in the finished condition for operation at 800 lbs. per sq. in., as illustrated, are 27 ft. $8\frac{3}{4}$ in. long, with a ram stroke of 25 ft. 9 in. and an external diameter over the body of 2 ft. $2\frac{3}{4}$ in., while the weight is 25 tons 1 cwt., the casting head being 3 tons 4 cwt.

NECOL INDUSTRIAL COLLODIONS, LIMITED, of Stowmarket, Suffolk, will in future be known as Nobel Chemical Finishes, Limited.

THE REPORT of the Open Shop Committee of the United States National Association of Manufacturers emphasises the fact that the cost of building is one-third greater under closed shop than open shop conditions. Over the country as a whole the additional building cost due to the closed shop is $500,000,000 (£102,880,658). It favours the elimination of clauses put in Government appropriation measures at the request of closed shop unions which prevent the Government from using up-to-date efficiency methods, and also the elimination of clauses which prevent Government funds being used to prosecute labour unions for acts which are deemed criminal if performed by other private groups. The cost to the public of strikes in the United States in 1924 was $613,000,000 (£126,250,000). Strikes in the nine years, 1916 to 1924 inclusive, have cost the public over $10,000,000,000 (£2,057,500,000).

Discussion on Mr. Cooper's Paper on "The Standardisation of Foundry Equipment."*

A meeting of the London Branch of the Institute of British Foundrymen was held at the Engineers' Club, Coventry Street, Piccadilly, W.1, on Thursday, February 11. Mr. G. C. Pierce, the Branch President, was in the chair.

Before commencing with the business of the evening MR. V. C. FAULKNER (President-Elect of the Institute) made a personal appeal for subscriptions towards the fund which is being raised for the purpose of financing the Institute's Convention, which is to be held in London in June, concurrently with an exhibition of foundry equipment and materials. Mr. H. G. Sommerfield (Hon. Branch-Secretary), he said, had already made an appeal, and at the moment something like £200 had been subscribed. Further subscriptions had been promised, but, including those, the total was far short of £1,000, the amount necessary. The committee had been working very hard, but they appealed to the members to support them in every possible way. They were very anxious to receive even the smallest subscriptions, which would be acknowledged through the Press, unless the donors wished to be anonymous.

Cast-Iron or Mild-Steel Gaggers.

The BRANCH-PRESIDENT, opening the discussion, said there was room for standardisation, and he was in agreement with Mr. Cooper on quite a number of the points. Without wishing to embark upon a course of destructive criticism, there were one or two points he wished to refer to. In the first place, he had had a fair experience of cast-iron gaggers, and was inclined to disagree with Mr. Cooper's contention that they were expensive. In the case of a fair-sized chill, for instance, anybody could put a spare drop of metal in as they were passing, in the form of a cast-iron gagger, and the cost was practically nil. Cast-iron hooks had a short life, due to breakages, but they all went back to the cupola without serious loss. If common iron or mild steel were used for making gaggers, there was the cost of bending. Certainly those gaggers had a much longer life than those made of cast iron, but, altogether, he believed that on balance the cast-iron gaggers would be the less expensive.

Testing Mould Hardness.

Referring to the instrument mentioned for testing the density of the mould face on the lines of the Brinell test, he said he had seen the instrument demonstrated, and could not agree that it would be very useful in a foundry. In the first place, with such an instrument one could not test the whole of an intricate mould. Obviously, the purpose of the instrument was to test the hardness of the mould, with a view to preventing scabbing, but in intricate moulds there were bound to be places which would easily scab, and which could not be tested with the instrument mentioned, although it could be used on square or cylindrical moulds, but in a well regulated shop one would hardly expect to see much scabbing in such moulds.

The Over-milling of Sand.

The Branch-President also disagreed with the author's remarks as to the effects of the over-milling of sand. Some time ago a paper had been read before the London Branch by Major Rhydderch, who was a prominent man so far as the investigation of sand was concerned. He himself had asked on that occasion what was the effect of over-milling the sand in a mould, how far it reduced the grain size and resulted in silt. The author of the paper had replied that he had tested sand which had been badly over-milled, and had been surprised to find that there was practically no reduction in grain size.

Standardising Rammers.

Another point on which the Branch-President differed with Mr. Cooper was that of the standardisation of rammers. It was his experience that, though rammers might be standardised, no two men used those rammers alike, and the human element was all-important. A man with a medium-sized rammer would do just as much work, and probably more, than a man with a large rammer. He did not mean that he would permit a man to use a small rammer with no head at all, but he did not consider that standardisation of rammers was essential, in view of the great extent to which the human element entered into the matter. One could ram quite well with the feet in some cases.

Moulding Boxes.

As to moulding boxes, and the author's recommendation for a thickness—he presumed he meant cast-iron boxes—of 5-16 in., up to the size of 20 in. × 12 in. × 4 in., he pointed out that the human element also entered into that question, and he would be very dubious as to the life of such boxes in the foundry to-day, particularly if they were put into the stove many times. In advocating the use of a thicker box, he did not suggest that it should be, say, 1 in. thick, but 5-16 in. did appear to be too thin. It was a very difficult matter to get what he called the old type of foundry labourer on whom one could depend to do his bit in the best possible manner. One had to put up with quite a mixed assortment, due to economic factors, and he would not care to trust a few of them to handle boxes 5-16 in. thick. He should think that a box of the size mentioned should be at least another ¼ in. thicker.

MR. V. C. FAULKNER thought that the Branch-President had failed to realise that the lecturer had put forward the statements in his paper in a tentative spirit. He did not think the author wished to be arbitrary, otherwise he would not have adopted the title he had, and his intention had been rather to establish a basis for discussion, in which particular he had succeeded. Referring to the machine for registering the density of the mould face, on the lines of the Brinell test, he said there were two such machines on the European market, one of which was capable of dealing with more or less restricted places.

Standardised Spindles.

He did not know whether the members were aware of the fact, but on the French market there were standardised spindles, though he had never heard of them on the English market. One must bear in mind that if some of these elementary things could be standardised, they could be turned out on a large scale by one foundry, and they would come into the moulder's hands at a price lower than that at which the moulder could make them himself. Home-made articles of this type were dearer than those bought outside, when one considered the time spent on them by the various foremen and managers. Foundry people often showed him with pride the articles they had made for themselves, but he had often wished that he could get hold of the true costs of those things. When speaking of blackings, the author had suggested that one might get an increased sulphur content in the finished casting. If one made a mathematical calculation, however, he believed it would be found that the sulphur increase would not be worth while worrying about. Before the war he had written to every manufacturer of graphites and blackings that he could find, and had analysed their products. Some of those products carried as much as 50 per cent. of ash, but since that time he was pleased to note real progress had been made, but there was room for standardisation.

Thin Boxes are Relatively Stronger.

With regard to the Branch-President's suggestion that the moulding boxes referred to by Mr. Cooper were too thin, he reminded him that, in the ordinary way, the thinner the cast iron the stronger it became, and increased weight did not

* This paper appeared in our last issue.

always mean increased strength. In thanking Mr. Cooper for his paper, he said that he himself, as a metallurgist, had enjoyed it immensely.

Wastage in Gaggers.

Mr. Cooper, replying to the Branch-President, said his experience of cast-iron gaggers was that one was always out of the size required. The gaggers became broken, they were laid about in the sand and constantly dug up, and the life for a lifter was about three days. In his opinion it paid to use the best iron for making gaggers, and to have a standard size for the foot and a standard size for the top. Again, the c.i. iron deteriorated very much, and if it were thrown back into the cupola it could only be used for the roughest of work, as it was covered with sand, clay-wash and dirt. One foundry he knew of, in which there were eight jobbing moulders on the floor, used cast-iron gaggers, and every day two men were making gaggers from the time the cupola was started until it was stopped. Those gaggers were considered of so little importance, and so easily made, that they did not attempt to get them out of the boxes, but simply chopped them off and made fresh ones. He would not say they would not have lasted longer, however.

Mould Hardness Tester as Basis for Comparison.

Different foundries used different sands, and each sand called for a different degree of hardness in ramming. A man starting in a fresh foundry might point out that they were ramming too hard, or too soft, but if such a machine were in use it could be demonstrated that a certain registration was used throughout that foundry for moulds of certain depths, and it would settle the question at once.

Sand Mills as Power Wasters.

As to the milling of sand, he asserted that the sand could be destroyed, but what he had in mind was not so much the destruction of the sand, but the point that there was no necessity for driving big weights of rollers round. Since he had written the paper he had seen a catalogue, in which he had noticed that the surface speeds varied from 150 ft. up to 400 ft. for exactly the same size of mill. The heavier the roller the higher the surface speed, in some instances, whilst in other cases as the roller became heavier the surface speed decreased. It showed what a considerable amount of horse-power was being used in one instance as compared with another to accomplish the same object.

He did not agree that every man preferred his own weight of rammer, but it was far better to have a standard, and to use the same weight always for a particular class of work. He agreed with the Branch-President that one could ram with the feet, but when ramming with the feet one had a bigger surface contact than when using a rammer, and one did not ram so hard with the feet. As to the thickness of moulding boxes, he had seen boxes ¼ in. thick which had been used for twenty years, and were still being used. They were used by the old Brook's Sewing Machine Company. With such a light box one could get far more work done. The boxes he had referred to were never put into the stove.

Mr. J. Ellis (Past-President of the Institute), whilst agreeing as to the undoubted importance of standardisation, and thanking Mr. Cooper for his paper, with much of which he agreed, was disappointed that nothing had been said about the standardisation of the moulder, because very much that was in the paper was of no use until the moulder was standardised. As Mr. Cooper had said, one man could ram a large bed plate quite well with a shovel handle and a flat rammer, but another man with the same tackle, assuming that to be the standard, would make a waster. Standardisation of the moulder, however, was impossible. The quality of the metal used had a great bearing on the thickness of moulding boxes. With some metal one could make boxes 1¼ in. thick, and they would not stand up to the work. Recently he had seen the stays of boxes 14 ft. long, 8 in. deep and ½ in. thick, and they had been used for many years, but were made of the very best cold blast iron. Speaking of gaggers, he said that cast-iron hooks had an advantage. For instance, they were far more rigid than in wrought iron, but the expense was greater.

Moulding Box Pins.

The moulding box pin question was a very vexed one. Some twenty years ago it was discussed, and all sorts of arguments were used. Some wanted square pins, some elliptical, others wanted cotter holes, others wanted screw pins. Whilst some said that the clamp was the best to hold the mould down others preferred weights. The human element entered into the question very largely, but he believed that the very best method to-day, especially for repetition work, was a standardised hole in both top and bottom, and a master pin. Perhaps one or two dozen pins would suffice for the needs of a foundry. The pins and holes were the same size, there were no lap joints, and there was no danger of the pins getting knocked, worn and broken. With regard to skimming with a piece of tubing, that could be extremely dangerous, and he had seen the metal shot right through the tube and out the other end. He liked the sketch of the runner plug in Fig. 6, because the ordinary type sometimes caused a great splash, and often somebody got burned. There were some things which could not be standardised, because of the human element, but there were many which could be standardised, and the members of the Branch would come to the conclusion that those matters were well worth considering.

Standardisation and Costing.

Mr. H. O. Slater (Past Branch-President) said he believed the day had arrived when even the employers were really interesting themselves, not only in the product of the foundry, but in the troubles connected with the design of tackle in the foundry—and quite rightly too. In many engineering concerns the equipment and design of the machine shops, pattern shops, and so on, were more than adequate, but the foundry was poked away in the most miserable corner of the whole concern. To-day, however, they were beginning to feel the necessity for proper production to meet the needs of the machine shops, and in that was largely bound up the question of cost. Some years ago the Institute had tackled the question of costs in the foundry, and the propaganda which had been carried on in that connection had had a great effect upon the trade. In the past the foundry had been regarded as almost a necessary evil. They had been asked to quote for castings per pound, and the employer, sometimes lacking the essential knowledge of costs in a foundry, had not known exactly what a particular casting would cost him. He would quote for an intricate casting at the same price as for a straightforward and easier job, and later the foreman would be blamed because costs were high. Costs and standardisation of equipment were largely bound up one with the other. In a foundry which he had visited he had noticed cupolas the workmanship in which was of the best that could have been put into the material, but the design, from a practical foundryman's point of view, was positively ridiculous, and manifested the danger of employing anybody other than a foundryman to design the most essential detail of the foundry. The foundry foreman was very often blamed for defective work, whereas it was due entirely to the bad design of the tools supplied by other people for his use. Speaking of gaggers of cast iron, he said that an arrangement consisting of a plate with two lugs at opposite corners and the trunnion in the centre, was very useful. It had eliminated a good deal of trouble during the war, and he had always had a good supply of hooks. He agreed that in a deep cod cast-iron gaggers were far superior to wrought iron, and in the case of steel work he very much favoured cast iron.

Jobbing Foundries Can Pay.

Mr. L. Tibbenham said that the standardisation of the moulder was hardly possible, but with the present moulding machines the founder did get standard moulds and standard castings. A few days ago he had been concerned with the making of two castings, one to fit inside the other, without any machining whatever. They had been made from a plate pattern, and they came together

very well. Without thinking anything about it, he had put the plate on the moulding machine. Several hundreds of these castings were being made, and when they were fitted together it was found that they were very slack. That was a very serious thing, but if they had used the moulding machine from the beginning they would have had a standard casting. Mr. Cooper had rather frightened him when he had mentioned all the troubles that he had seen in the foundry, and he himself, as an employer, would be very embarrassed if he saw all those things happening in his own foundry. It would not be possible to allow such things to go on in a jobbing foundry. He had to quote competitive prices, and if he had no system of costing, as Mr. Slater appeared to think was the case, he would not make any profits, but, as a matter of fact, he did make profits as a jobbing founder.

Difficulties of Standardisation Stressed.

MR. M. E. GALLON (Past-President of the Newcastle Branch of the Institute) said there could be no hard and fast rule with regard to the density of sand, and, no matter what instruments were used, one man would make a mould harder than another. There was a peculiar touch which had to be acquired in dealing with sand, and it was only acquired by long experience, and if the man who was ramming, whether he used a large or a small rammer, did not understand his job there would be trouble sooner or later. There was a good deal of unnecessary milling of sand, and he had cast jobs weighing up to 24 cwts. in green sand, which had not been into the mill at all, but was just mixed up by shovel. Speaking of the standardisation of the central pin in the socket, he said that every foundry standardised in its own way to suit its requirements, and no hard and fast rule could be laid down. In his own foundry they had probably half a dozen or more centres, which could be used for any job, and they all fitted a certain size of pin, 2½ in., 2 in. or 1¾ in., as the case might be. No matter how far standardisation was carried, the same result could not be obtained every time in a foundry, because of the human element.

Can the Skilled Moulder be Replaced?

The BRANCH-PRESIDENT, discussing the standardisation of the moulder, said the fact must not be lost sight of that distinct efforts were being made in that direction to-day, and a uniform system was being worked in the south-east of England for the training of apprentices to a definite standard. One recognised, of course, that the psychology of the moulder, and the human element as it was generally understood, could not be standardised. So far as he could see, those concerned were training a fair number of men for executive positions, but he was inclined to agree with Mr. Slater that, if there should be a trade boom, as we all hoped, there would be a deficiency of skilled men in the foundries. The standardisation of costing methods had its disadvantages as well as its advantages, and there was a danger of excessive standardisation. He had had experience of foundries, in which it had been the custom to ascertain the costs to within four points of a penny per lb. of castings, and, because of that detailed costing, the foundry was not allowed to have moulding boxes and other tackle, whereas, if those concerned had not been so fully aware of the cost involved, they would have provided for good tackle.

A Modern Conception of Industrial Needs.

MR. J. W. GARDOM pointed out that if there was no costing at all in foundries, however crude it might be, there would be no foundries. It was not necessary to go into minute details in foundry costing, and it was probable that the foundry management did not know the exact cost of certain small jobs, because it was not worth while going into it, but they knew the costs of the bigger jobs they turned out. With regard to the training of moulders, he was of opinion that the question was being discussed from the wrong point of view. It was advisable to grow with the times. To illustrate his point, he said that at one time Messrs. Lucas produced the best oil lamp for bicycles. If that firm had decided to make nothing but oil lamps, and to train men to make those lamps, they would not be in business to-day. If we could not produce sufficient skilled moulders, or could not interest sufficient men to become skilled moulders, was it not better to face the fact, and train men who did know something about the way the job should be done, so that when the boom came—and it was coming fast—their services could be augmented with those of unskilled men, whom they could train for the work? The same thing had happened in the Army, where the men who had enlisted during the war were trained by the N.C.O.'s.

Standardised Tackle Augments National Foundry Wealth.

MR. V. C. FAULKNER said that, generally speaking, he had been disappointed with the discussion, because it had been so destructive. Speakers had said that we could not do this and could not do that, and had drawn attention to the human element. but Mr. Gardom, in exhorting foundrymen to see what they could do under present conditions, had guided the discussion into the right lines. But for the fact that the Annual Conference was to be held in London, and the London Branch was very busy, a committee might usefully have been set up to deal with standardisation. If that committee did not agree with the rammer suggested by Mr. Cooper, let them suggest an alternative, or have three standard rammers if such could cover the ground. The same remarks applied to boxes. Although there were a large number of types of cast-iron boxes in use, he believed it was possible to produce a thoroughly good design which would cover the major requirements of the trade. There could be a standard drawing, and from it a standard box would be bought on the open market at a standard price, whereas at present, if one went to a foundry sale, one could not buy boxes, because they were not suitable for one's work. There was a great deal, therefore, in what Mr. Cooper had said.

Necessity of Skilled Men Emphasised.

MR. H. O. SLATER disagreed with the idea which Mr. Gardom had propounded with regard to the training of the moulder. What he himself wanted to point out was the necessity for having available really trained practical foundrymen, who could take over the management of the foundry, on the practical side and the commercial side. He himself had been trained as a soldier in a fortnight, but one could not train a moulder in a fortnight. It was necessary to have thoroughly trained men available, so that they could be employed at the right time, because if they were not available, national wealth was lost.

Cardinal Points Sought.

MR. GARDOM said Mr. Slater had missed the point that what the foundry had to do was to sell castings and make a profit. It did not matter whether the man who made those castings was a really trained man, or whether he was an unskilled man under the supervision of the technical man. Mr. Slater would say that the only factor in the making of a casting was the moulder, but as a fact he was only a part of it.

MR. SLATER said he was the most essential part.

MR. GARDOM disagreed, and said that the iron was the most important factor. (Laughter.)

Points Cleared Up.

The BRANCH-PRESIDENT was inclined to think that both Mr. Slater and Mr. Gallon had missed Mr. Gardom's point. All that Mr. Gardom was suggesting was that, if we could not get skilled men, we should adapt ourselves to the circumstances, and get over the difficulty by using machines, and in other ways. These difficulties had had to be overcome before. Whilst he agreed as to the necessity for skilled men, he wanted to point out—it was not a conclusion arrived at on the spur of the moment, but as the result of his experience over a period of years—that to-day, in spite of the slump in trade, there were more skilled men employed in the foundries than there were 25 years ago, although that period had seen the introduction of machines, and the various economic difficulties that had arisen had had to be overcome. The demand for skilled men could not be

reduced with the introduction of better methods of production, because, with the march of progress, there arose a demand for other things which necessitated the employment of skilled men, and their number would increase rather than decrease.

Box Pins.

MR. COOPER, replying to Mr. Tibbenham, said that, necessarily, all the faults he had referred to did not occur in the one foundry, but in a number of different foundries. He had no doubt, however, that if Mr. Tibbenham had several sizes of moulding boxes in operation in his foundry, 2 ft. sq., 1 ft. sq., and so on, they all required different sizes of pins. It would not be unusual to find that state of affairs in a foundry. There was no doubt that the use of loose pins, as suggested by Mr. Ellis, was the best system of all.

In reply to Mr. Gallon, he said he had not suggested that gaggers should be cut out altogether, but that the founder should have a standard, and use either all cast-iron or all wrought-iron gaggers. The question of whether or not a mould was hard enough was always a debatable point, but if the instrument for recording sand face hardness were used—and it would be adopted—it would do away with all the discussion and argument which now took place. He agreed with Mr. Gallon's remarks as to the milling of green sand. For the greater part of his early life in the foundry he had been concerned with green sand work for both heavy and light castings, and the sand was not milled because it did not need it. It was in its natural state as regards texture and grain size, and only required milling when used for bench work.

Splitting Up the Moulder's Trade.

On the controversial subject of the standardisation of moulders, his idea would be to train rammers, finishers and closers in all foundries. There was nothing new in that principle. As the engineering trade had developed the workers had split up into fitters, millers, drillers, and so on. The glass bottle trade had been split up years ago. The foundry trade would have to come to that, and there were men in the foundries at present who did nothing but finish and close. When he had spoken of the training of the moulders and the standardisation of the rammers, the idea he had had at the back of his mind was that the wage earner to-day was not taking any interest in the business; it was not his life-work, in the sense that it was in earlier times, but was merely a means of earning a living. No man to-day made it his life's work, as did the craftsman of earlier days, who was not content to finish at 5.30 p.m. The same remarks applied to the employer. There were very few men like Henry Ford, and the employer looked forward to finishing his work and leaving himself free for his golf, his evenings out, and so on. After all, that was quite natural.

MR. R. J. SHAW, proposing a vote of thanks to Mr. Cooper for his paper, said that he had not discussed the paper because in his own foundry 75 per cent. of the suggestions made by Mr. Cooper were carried out. A question which had not been mentioned, however, was that of the splitting of boxes at the corners. Heavy boxes, when they had been used about twice, split at the corners, and it was difficult to patch them up sufficiently strong to be quite safe, but he thought the method indicated by the lecturer an excellent way of getting over the contraction strains which caused the fracture. He understood that what was done was to core a slot out of the corner forming a flange on the inside of the side of the box, and afterwards fill the slot with packing and bolt the side flange and the end of the box up. He himself put a round core in the boxes, but he had known heavy boxes, with a great many bars in the top part, and which one could not prevent cracking.

MR. J. W. DUNN, who seconded, pointed out that standardisation was very difficult in a jobbing foundry, where in one day one had to cast a hydraulic cylinder, a few machinery castings, then fire-bars and buffer plates, and finally bed blocks. In such a foundry, running 20 tons of metal a day, with instructions from the management that nobody was to be in the shop after 5 o'clock, standardisation was difficult.

The vote of thanks was accorded with acclamation.

MR. COOPER, responding, said that many people had not even thought about many of the things referred to in the paper, and much could be done in the direction of standardisation. One could not have standardisation, however, unless one was prepared to pay for it. In his view there was more room for standardisation in the jobbing foundry than in any other, because it was the lack of standardisation in the jobbing foundry which was responsible for the ridiculous prices quoted to-day. There was no system in such foundries, and the purpose of his paper was to urge the trade to get down to some standard system of working.

Discussion on Mr. Longden's Paper on "Liquid Shrinkage in Grey Iron." *

MR. A. L. KEY, in proposing a vote of thanks to Mr. Longden, said many of the audience would have liked to have the experience of proving for themselves what Mr. Longden had told them, but to do so would involve much trouble, and they had other duties to perform, so these things had to be relegated to a secondary place; it was fortunate, therefore, that they were able to profit by the experience of others who had investigated these problems from a practical point of view. This was seconded by MR. J. G. S. PRIMROSE.

The vote of thanks was passed unanimously.

The CHAIRMAN (MR. J. Masters) asked what Mr. Longden's experience had been with oil-sand cores. If they had not been thoroughly dried what was the effect with regard to producing soundness when the metal was getting to the point of solidification?

With regard to runners, it was not the size alone that had to be taken into account. The distribution was also an important factor in getting satisfactory results.

MR. LONGDEN said his experience was that success in the use of oil-sand cores all depended on how the core was made. Take a core which was struck off with a strickle, with a long cast plate at the underside of the core. At one time he had trouble with that type. In a casting, a sketch of which he showed, the bottom face was machined all over and highly polished. In one or two cases he found a number of holes on the machined surface, and the casting had to be scrapped. Looking at the core one day he observed drops of water underneath, and he came to the conclusion that in the scrapped castings referred to the water had condensed on the surface of the core and remained there until the molten iron reached it, spitting up the pellets of metal in the mould, which were later dug out by the cutting tool. Being in a hurry he had occasionally put cores in which at the moment were not sufficiently oxidised, not sufficiently dry. The result had been that in casting there was a great rush of flame through the risers. But in no case had he experienced any ill results which could be attributed to the use of oil-sand cores. If the core was dried so as to stand up well in the mould it would be satisfactory.

MR. A. L. KEY said it was only under certain conditions that gas was present in the liquid metal. Blowholes showing in a casting after machining, might be attributed to gas evolved from the metal in the mould, but it was dependent upon the condition of the metal before it entered the mould. He made a series of castings which were very hard, the silicon being 0.7 per cent. Usually he cast them with the hottest metal possible, the temperature being about 1,400 deg. C., and they were perfectly good, not a sign of blowholes. On one occasion, however, he waited till the temperature had fallen 150 deg. C. and that casting came out full of holes. In the case cited by Mr. Longden of the two open-sand-cast plates, the one which was left uncovered was speckled with holes, while the one which was covered with a thin layer of sand was perfectly

* This Paper appeared in our issue of February 4.

sound. The reason was that the latter was not exposed to the atmosphere. He drew the inference that at a certain temperature iron had a great susceptibility to absorb oxygen from the atmosphere. His opinion was, and had been for a long time, that if hot metal was poured into the moulds there was little fear of gas being evolved from the metal itself. Blowholes were caused by the metal being at an undesirable temperature prior to going into the mould; assuming the moulding conditions were normal.

MR. A. JACKSON said it seemed to him that in casting metal out of the same ladle there would be differences in the resulting material. If poured very hot and settling quickly it would be an iron of close texture, because the carbon was present as combined carbon. As it stiffened the graphitic carbon was formed, making a lighter iron, the volume was greater. At the finish it was a light iron of open texture.

A heavy runner should have been used for sinkings, but where the machining was not an important factor very often a small fine runner could be used. Run with judgment, it produced the same effect, but the metal would not be as close an iron. The metal came in slowly and gradually set as it was poured out.

MR. KEY said his advice was, "Do not wait for the temperature to come down to a particular point. If the job has to be machined or has to withstand hydraulic pressure tests, cast with the metal as hot as you can get it, whatever the size of the casting." He had followed that rule with a massive-sectioned 7-ton flywheel, and it turned out a good job. When he had waited for the temperature to fall he had not been successful.

MR. JACKSON remarked that everyone must use his discretion in that matter. It depended on the particular article being dealt with. If it was something which had not to be machined and did not require a high polish, he would certainly take the colder metal, but if it had to be polished, use the hottest metal that can be obtained. The hotter metal would be closer in texture and better for polishing, because the graphitic carbon had not had time to form; it was in the combined carbon form, and the material was of much closer grain.

MR. S. G. SMITH said in the main he agreed with the statements put forward in the paper, but one or two matters had been raised on which he would like to say a few words. The last speaker was correct in what he said regarding combined carbon and graphitic carbon. With combined carbon, *i.e.*, carbide, the carbon was dissolved in the iron, it was not present in graphitic form. There were various types of graphitic carbon in the casting as modified by size, form, and distribution. Then reference had been made to the metal in the last of a series of castings from the same ladle being lighter than the first. It appeared to him that would be so naturally, because, supposing they were running with the same kind of runners, there would be a difference in the swelling pressure due to the higher temperature of the iron.

He did not quite follow Mr. Longden's suggestion that iron with a shorter freezing range could be fed longer than iron with a long freezing range, but he quite believed that a sounder casting would be got from the harder iron. He had often shown to young men a number of 12 in. cubes cast with various kinds of iron, from very soft to very hard, and pointed out to them the variations in liquid shrinkage. The conclusion he arrived at, from his experiments and observations, was that iron of medium hardness gave the least liquid shrinkage. With very soft iron he got about the same degree of shrinkage as with very hard white iron, but it was a different form of shrinkage. In the former there was a very porous patch with cavities: in the other case one got a depression at the top but underneath it was sound and hard.

He was in agreement with Mr. Longden's remarks on head feeding. He had had a good deal of experience of head feeding with all kinds of vertically run castings, probably more than any other man living, and his advice was: With head-feeding for vertical castings, never let the distance from the bottom of the flange to the top of the feeder be less than 9 ins. With a shorter distance there was often a cavity just at the top of the flange, and the machine cut it off. With certain grades of iron which had not much shrinkage it would clear with less than 9 ins., but that was his fixed figure.

Reference had been made to hot metal and dull metal. What was meant by those terms? If they could be defined by reference to colour by Pouillet as was given in Hiorn's "Elementary Metallurgy," or if people would speak in degrees Centigrade, they would get nearer to understanding one another. Of course some cupolas melted what would be called a dull iron compared with the white hot iron melted in other cupolas. In other words, what would be considered a very high temperature in one foundry, may be considered only a medium temperature in another foundry. Hence the need of some intelligible form of expression.

MR. KEY: In large castings what I describe as hot metal is in the region of 1,350 to 1,380 deg. C.: in smaller castings it is about 1,400 deg. C.

MR. LONGDEN said perhaps he had not made himself clear with regard to what he meant in saying that iron with a short feeding range would feed soundest. He did not mean to refer to the process of feeding by the rod; he meant natural feeding by gravity.

He was not sure he agreed that in the case of the castings, of which the last out of the ladle was the lightest, it was explained by eating-in of the mould face. He had practised casting very hot, and on the face of it that might appear to give weight to what Mr. Smith had said, but if Mr. Smith had seen the castings in question he would have agreed that for all practical purposes the last was equal to the first: he could see no difference in the degree to which the surface of the mould had been eaten into: there was no distinctive difference between the irons in that respect.

With regard to Mr. Jackson's remarks, he believed they were in practical agreement. He had no ground for assuming that cast iron, if of a eutectic composition, and which was not supersaturated with carbon, had graphite present in the liquid. It might be so, but he did not know. But he did think that a good many cast irons in the foundry were super-saturated in respect of carbon, and in those irons the carbon tended to come out of solution in the liquid in a more or less degree, and remain distributed and not float away as one might expect. Some of it remained distributed throughout the metal, reducing its density and reducing the weight of metal which could be put into a given space. That gave some degree of support, or rather tended to explain, why in such cases the last casting was lighter than the first.

Mr. Key was perfectly right in his suggestion regarding casting hot. It had been the experience of perhaps nine out of ten foundrymen—it was his personal experience—that hot castings gave the best results. He wondered whether in the case described the core was damp.

MR. KEY said the core was overdried and he was afraid of the metal getting into the straw band because of the metal being so hot.

MR. LONGDEN said apparently in such a case, if there is any bubbling, there is a tendency for a slight local bessemerising to take place, with resultant reactions which may later be responsible for holes.

MR. A. SUTCLIFFE said if it was desired castings should not be drawn in any shape or form one must run it slowly or feed it with hot iron after it had been cast.

MR. H. SHERBURN said discussions of this kind reminded them of the complex nature of the material they dealt with, the varying conditions of moulding and the further complications arising from the human factor. They realised how great were the difficulties of the foundrymen's job. He was coming to the conclusion that those in charge of foundries, unless they possessed some form of second sight or of intuition which psychologists did not tell them much about, would have to rely to an increasing extent on purely scientific assistance in their difficulties. Few of those present had those resources.

MR. KEY remarked that he thought his statements were quite justified because they were based on his personal observations of the results of differences in casting jobs over many years.

The discussion then closed.

Permanent Moulds.

On a recent visit to the foundry of Aiton & Company, Limited, of Stores Road, Derby, our representative had the privilege of inspecting a new process of permanent-mould cast-iron casting manufacture. Basically, the process consists in the provision of a mould, the facing of which consists of a special refractory material which does not adhere to the iron, and strips so cleanly that, beyond re-blacking, is suitable for recoreing and closing ready for the reception of liquid metal. The facing is from 1 to 2 in. in thickness, varying with the weight of metal to be introduced. During the visit, large-diameter flanged pipes were being made, and obviously we were interested to see how contraction would influence either the flange or the mould. The method of taking care of this is to have a few inches of ordinary moulding sand between the inner side of the flange and body of the casting, which is re-moulded for each cast. For 14- to 20-in. dia. pipes the mould can be filled as many as three times during an eight-hour day. Obviously, the mould is fairly hot for the second and

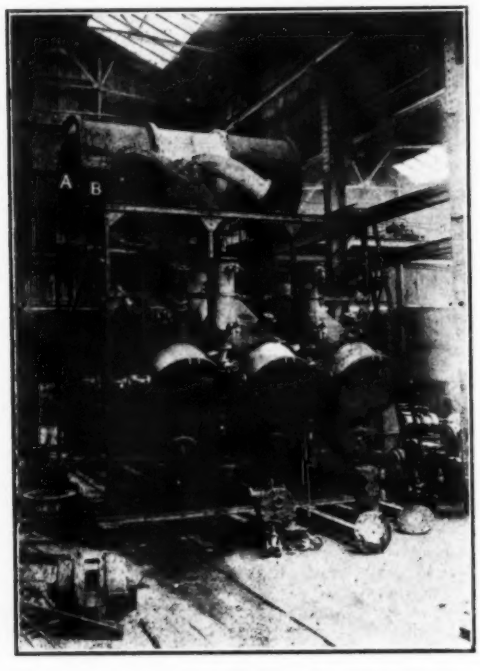


FIG. 1.—SHOWING TWO TYPES OF CASTING A AND B, WHICH HAVE BEEN CAST IN PERMANENT MOULDS.

third pourings, and composition is modified a little to take care of this. One of the snags of the process is the liability of the moulders to burn their hands, but *experientia docet*, and they soon learn to take care.

On posing the hypothetical case of a casting for which repeat orders came along at infrequent and lengthy periods, and the possibility of storing the moulds, Mr. Aiton, Jun., kindly had a number of moulding boxes and tackle removed from the mould which had been used three months previously for the manufacture of the 7-ft. dish casting shown at A in our illustration. Four of these are incorporated in the cylindrical portion of the apparatus illustrated. The casting had been bedded in the floor, and all three castings had been made in the same day. We were informed that the moulding costs of the four castings were in the ratios of 13:1:1:1. The mould was in perfect condition; it was rock hard, and, after skin-drying, could have been used that day. This was after an interval of three months. The castings shown at B are also permanent mould castings. The maximum number of castings which can be obtained from moulds of this character has not yet been determined.

No exaggerated claims are made for the process, as the exploiters, the International Processes, Limited, of 3, Grosvenor Gardens, London, S.W.1, realise that there is a definite field of application, which is limited by the following desiderata:—(1) At least three castings must be made; (2) small castings at present can be made by either allied process or by machine moulding more cheaply; (3) certain intricate castings must be excluded; (4) the production of steel castings in permanent moulds has not yet been tried out; (5) a realisation that, whilst established for certain types of castings, the process is not one which eliminates the making and destroying of sand moulds of all types.

Nevertheless, the process is extremely promising, and is one which will be followed very closely by the British foundry industry.

Current Distribution and Price Problems.

By L. ZERZOG, Civil Engineer, Munich.

[*Abstract.*]

The speaker dealt with the production of electric energy, particularly energy derived from coal or lignite and water power. As the question of the price of current represented the *non plus ultra* in the working of electric furnaces, and widely divergent prices were found in different parts of Germany, he gave particulars of the production costs of energy obtained from the most varied raw materials. The Diesel engine was also referred to, with the aid of a comparative diagram.

The question was also raised as to whether the large German long-distance supply stations tend to lower the price of current, and whether the closed ring of Germany's 100-kilovolt line afforded the necessary reserves when one or other of the small power stations connected to it was unable to supply current permanently.

As a means of lowering the price and assisting the large power stations, the speaker suggested that both in the interests of the power stations and in their own interests every possible effort should be made to reduce the kw.h.-price by increasing the hours of use and the kw.h.-consumption.

Comparisons were drawn between conditions in Germany and conditions abroad, which showed that electric contracts were concluded at very much lower prices abroad than was generally the case in Germany.

The conclusion of contracts was then discussed, a critical analysis of several contracts being given.

Delivery Vans and Income Tax.

As there appears to be no uniformity of practice on the part of surveyors of taxes as to the making of allowances for depreciation of commercial motor vehicles, a London traders' association has inquired of the Inland Revenue authorities whether any standard percentage is observable for such depreciation, and, if so, its extent.

After correspondence, the Department notifies that the following rates have been agreed, subject to the concurrence of the Income Tax Commissioners concerned:—

Motor lorries and motor vans, 20 per cent. upon the written-down values thereof; 15 per cent. on commercial motor vehicles propelled by steam power (steam lorries) on the written-down value; 20 per cent. upon commercial vehicles propelled by power derived from internal combustion engines (motor lorries and motor vans) on written-down value. It is a condition of the allowances that all additions to and replacements of such vehicles shall be charged to capital, but all repairs and renewals, replacements of parts which do not destroy the identity of the vehicle, are treated as a revenue charge.

Glue for Draftsmen's Use.—Mix together 5 ozs. of glue, 2 ozs. of sugar, and 1½ oz. of water. Melt the whole in a water bath and cast in moulds of any shape desired. This glue can be dissolved for use rather easily in warm water.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

The Selling of Castings at Trade Exhibitions.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I have read with very great interest the articles appearing in your issues of the 4th and 11th inst., being numbers 25 and 26 respectively of a series on "The Selling of Castings," by "Voyageur," and giving in particular advice regarding the exhibiting of castings at trade exhibitions. Speaking as a trade exhibition organiser, and especially as a director of the firm responsible for the Shipping, Engineering, and Machinery Exhibition held every alternate autumn at Olympia, I thoroughly agree in the main with your correspondent's conclusions, and there are certain points he makes which I would seek, if possible, to stress still further.

In the first place, then, I agree with "Voyageur" that an intending exhibitor cannot pay too much attention to the class of visitor that it is sought to attract to the exhibition in which he is proposing to take part. Too many exhibitors, in my experience, are wont to attach too much importance to the number of visitors whom they see present in the gangways, and too little to the quality of those visitors from a buying point of view. As an outstanding example of this we have the Engineering Section of the Wembley Exhibition of 1924, when the finest display of engineering and electrical products that has ever been staged in any part of the world at any time was inspected chiefly by conducted parties of County Council school children and by members of the general public sheltering from the rain. That display may have been justified from a broad Imperial point of view, but as a means to immediate business and of enabling exhibitors to clear expenses, it can hardly claim to have been a success.

In the second place, I am in entire agreement with the remarks made with regard to the necessity for paying the greatest attention to the display of the exhibit, the stand fitting, the lighting, and the prominence to be given to anything of a novel character. Unfortunately there seems to be a tendency in these days of high prices and shortage of money for exhibitors to take their space from the organisers and then to economise to the utmost possible extent on fittings and accessories. I am constantly meeting exhibitors who urge me to make compulsory a standard scheme of stand fitting under the idea that all exhibitors will be saved expense in this direction. This suggestion I always seek to oppose to the best of my ability, first of all because I believe it to be made merely by those of niggardly temperament, who seek to limit the advantages which their more progressive competitors might gain from the outlay of a little more money and imagination, but chiefly because I believe that an exhibition presenting a uniform appearance without originality loses a great deal of its attractiveness to the visitor, and leaves him almost impressionless. Personally, I am convinced that the best policy is to allow the fullest possible liberty of action to every exhibitor in the matter of the appearance of his stand, restraining him only when anything he proposes to do threatens to interfere unduly with his neighbour's display.

Your correspondent makes some ingenious remarks with regard to the importance of estimating the density and period of the flow of visitors, and, of course, this is a subject which well merits the intending exhibitor's consideration, but I would point out that it is not always a desirable thing to be located on a clear road to a restaurant. Those who seek refreshment and have discovered their way to it are apt to be somewhat concentrated on the object in view, and on their return after repletion have perhaps some half-formed impression that they have inspected that part of the building and must seek to explore further afield. This is, of course, an argument only, and may be more than outweighed by the advantages of the assurance that the exhibit is situated on a much-frequented avenue of the building, but I merely cite it in order to point out that the selection of the best position is not always so simple a matter as it might at first seem. Then again, though it is, of course, important for an exhibitor to know where his stand will be located in relation to the public entrances and exits to the building, it is a very moot point as to whether an exhibit immediately opposite the main entrance is to be considered in the best position in the hall. As in the case of the stand near the restaurant, the exhibitor, it is true, is assured that his display comes to the notice of the maximum number of people visiting the exhibition, but there is on entering any building a natural moral, if not actually physical urge, to pass on *in medias res* instead of standing blocking up the entrance.

Finally, "Voyageur" makes a most important reference to the staffing of exhibitors' stands. One of the greatest, most deplorable, and, unfortunately, most justifiable complaints that I receive from visitors to various exhibitions is of the quality of attention they get from the representatives in charge. I am fully aware that it is a soul-wearing job to stand about for many hours a day for many consecutive days on a comfortless stand in a noisy, dusty, and probable draughty building, and that this is work which those in a sufficiently senior position to be able to do so too often fall victim to the temptation to pass on to their subordinates, but it must be obvious that it is practically useless to go to the trouble and expense of hiring and equipping a stand at an exhibition, and then to stultify, if not actually to negative, the good results by placing in charge those who have not either the will or the ability to answer inquiries intelligently. At the last Shipping and Engineering Exhibition I had the galling experience of taking a personal friend of mine round to various stands about 12 o'clock in the day, as he had actually that afternoon in the country a board meeting to consider the expenditure of several thousands of pounds on an electric generating plant for some new works. I say the experience was galling because: In the first place, possibly because the stand attendants knew me, and thought that no friend of mine could possibly be of any use to them, they paid no attention whatever to us when we inspected their exhibits and literature, and then, in every single case when we had eventually engaged someone's attention, we were merely referred to printed matter or to someone who would be "back after lunch," or "might perhaps be back later in the day, though they could not say for certain." I have no doubt that those responsible persons who could have given my friend attention had excellent reasons for not being at the exhibition, but the fact remains that one or other of those firms lost that nice fat little order because my friend was unable to take anything intelligible with him, and his co-directors decided later in the day to accept the tender of an enterprising firm who had already been in touch with them.

To turn for a moment to one or two points on which I am not in entire agreement with the writer of your articles, I cannot let pass without a protest the reference to "dearly-bought space"! In my humble submission the publicity to be obtained from intelligent participation in a trade exhibition of standing and repute is the least expensive of any in the world, but we will let that pass. In the next place, I do not know in connection with which exhibition your correspondent has experienced difficulty in getting all the plans he wants, as I should be very much surprised to find any of the established exhibition organisers, say, members of the Trade Exhibition Organisers' Association, putting any obstacles in the way of exhibitors acquainting themselves with all the details they may require to know with regard to the particular space they have taken or propose to take. I am aware that there are one or two organisers of exhibitions of a special character who, for reasons of their own, allocate the various positions to applicants by ballot, or only undertake to allot the area applied for, or a portion of it, without specifying position, so that the applicant is left in the dark as to where his exhibit will be situated in the building until the matter is settled for him and all the other exhibitors by the administration, but in all true

trade exhibitions of which I am aware, intending exhibitors have ample opportunity of selecting one of a number of available sites, and of possessing themselves in advance of all the information they require, unless, of course, they are extremely late in applying, when, as in most other things in life, they take what is left. Then, on a point of detail, while the early comer is obviously subject to the least interruptions in his erection work, I do not like the suggestion that those who come later on will find all the adjacent gangways blocked with other people's empty packing cases, or, for the matter of that, that those who come early will be allowed to utilise gangways for this purpose, as there is always a special staff keeping gangways clear and rationing facilities, and provided an exhibitor has made arrangements in advance for his fitting, transportation, lifting, etc., he should find no difficulty in getting these things carried out pretty much according to programme.

One last word of caution needs, I think, to be uttered on the subject of having stands made and prepared at an exhibitor's own works. Apart altogether from the expense of transportation both ways and the difficulty of securing suitable local labour for erecting, the exhibitor must remember that the local authority and fire office regulations in regard to exhibition stands are extremely strict, and go into the minutest detail necessitating the most careful study if trouble is to be avoided. It is extremely probable that on arriving at the exhibition building the day before a show is due to be opened, an exhibitor will find awaiting him on his carefully arranged and prepared stand an inspector of sorts who insists on the most drastic alterations forthwith, because some part of the structure is not of a specified thickness or some material has not been satisfactorily fireproofed, or the exhibit itself by its nature is held to offer special risks in respect of which regulations, as specially laid down, have not been observed. Incontinently, thereupon, the exhibitor must commence to dismantle and rectify his stand, as these authorities have power, which on occasion they do not hesitate to use, to close an exhibition or to refuse to let it be opened until their regulations are complied with. Unless, therefore, all these difficulties are foreseen and provided against, an exhibitor will be well advised to place his erection work in the hands of some specialist firm who do nothing but this work throughout the year, and who know just what may and may not be included. The suggestion that there are insufficient of these firms in attendance at exhibitions to cope with all the work entrusted to them in the time specified does not, I think, state the whole of the case. As in most other lines of business, there are many standfitters, some good and some bad, and whilst the latter variety will undertake any work at the shortest notice and with no regard to what they already have in hand, hoping somehow to scramble through at the last, firms of repute can be absolutely relied upon to carry out work to scheduled time; if it were not so, how could the vast exhibitions which Olympia contains be completely ready on the opening day when a week or ten days is the utmost time which has elapsed since the exit of the previous tenant? The answer to this again, I think, is that firms must not be led to accept the lowest quotation from standfitters regardless of their repute and size of the firm concerned, but if they will only take the advice of the organisers in this, as in other particulars, they will find their path made very much smoother for them.

The above remarks are addressed primarily to potential exhibitors of castings, as the articles which gave rise to them were so addressed, but they apply, of course, equally to exhibitors at any trade show, including, naturally, our own Foundry Trades' Exhibition at the Agricultural Hall next June, and if you can see your way to give publicity to them or any excerpt from them in the valuable columns of the FOUNDRY TRADE JOURNAL I shall esteem it a great favour.—Yours, etc.,

KENNETH W. BRIDGES.

Avenue Chambers,
4, Vernon Place,
Southampton Row, W.C.1.

New Companies.

Arthur Heaton & Company, Limited, Valley Works, Liversedge.—Capital £15,000 in £1 shares (5,000 Six per cent. cumulative preference and 10,000 ordinary). Engineers.

F. N. P. Manufacturing Company, Limited, 115, Colmore Row, Birmingham.—Capital £100 in £1 shares. Pressure-gauge makers, platers, etc.

Siemens and General Electric Railway Signal Company, Limited, Caxton House, S.W.1.—Capital £20,000 in £1 shares (10,000 "A" and 10,000 "B"). Directors: Max J. Railing, S. D. White, F. Hird, and Dr. Hy. R. Wright.

Urquharts (1926), Limited, Grove Avenue, Queen Square, Bristol.—Capital £10,000 in 8,650 ordinary shares of £1 and 2,700 'B" shares of 10s. Manufacturers and installers of oil burners, engineers, etc. Directors: C. L. Hill, M. Whitwill, C. F. A. Hare and G. U. Morgan.

Wood, Russell & Company, Limited, 34 and 36, Oxford Street, London, W.—Capital £7,000 in £1 shares. Mechanical, electrical and general engineers. Directors: P. N. Wood and G. D. Russell (both permanent).

Company Reports.

National Gas Engine Company, Limited.—Net profit, £39,147; ordinary dividend, 4 per cent.; carried forward, £16,394.

Mather & Platt, Limited.—Final dividend on ordinary shares, 5 per cent., together with bonus, 5 per cent., both free of tax, making 15 per cent. for year; carried forward, £178,281.

Obituary.

MR. T. H. TREGONING, who died at Illogan recently, at the age of 93, had spent all his life in the foundry trade in West Cornwall. About 40 years ago he invented what is known as the dipper wheel, which is still used in raising tin-bearing slimes from mine streams. He was also associated with Michell's and Tregoning's patent pulveriser, from which the tube mill now in use developed. Both these appliances marked a distinct advance in mining methods, facilitating the work and making it more thorough. Mr Tregoning had as a business colleague for some time Capt. W. J. Hocking, of Camborne, but his last working days were spent as manager of the Redruth Foundry Company.

Personal.

MR. J. W. KEMPSTER, a director of Harland & Wolff, Limited, has been elected president of Greenock Chamber of Commerce.

MR. J. R. DIXON, managing director of the Cleveland Bridge and Engineering Company, Limited, of Darlington, has been elected to the position of chairman, rendered vacant by the death of Mr. W. E. Pease, M.P., and will hold the dual positions of chairman and managing director. Capt. Ernest H. Pease has been elected to the vacant position on the board.

Wills.

BARRETT, K. D., engineer, Gosforth, Northumberland £13,962

Contracts Open.

Abersoch, March 4.—Cast-iron mains, at Abersoch, Carnarvonshire. Mr. S. B. Wilmot and Mr. A. H. S. Waters, 63 Temple Row, Birmingham. (Fee £1 1s., returnable.)

Edinburgh, March 9.—Rails, for the Corporation. The Tramways Manager, 2, St. James's Square, Edinburgh.

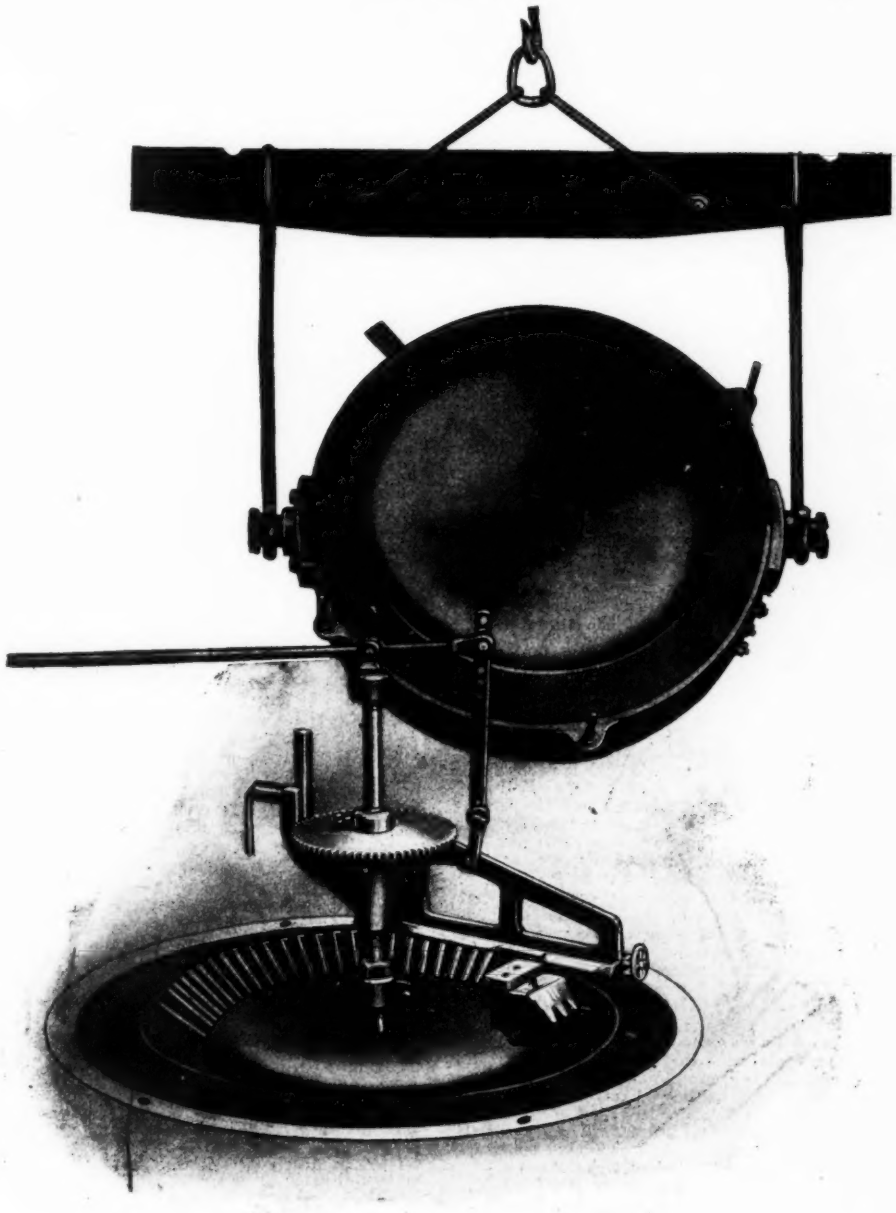
Rothwell, near Leeds, March 4.—Pipes, for the Urban District Council Mr. G. F. Moorhouse, clerk, Council Offices, Rothwell, Yorks.

Stoke-on-Trent, March 2.—Iron and steel, for 12 months commencing April 1, for the Town Council. The chief gas engineer, Mr. A. McKay, Gasworks, Etruria, Stoke-on-Trent.

Swanage, March 1.—Mains, for the Urban District Council. The Clerk, Town Hall, Swanage.

The "VULCANIA" PATENT WHEEL MOULDING MACHINE.

Patent No. 5049.



THE "VULCANIA" PATENT WHEEL MOULDING MACHINE is for moulding spur wheels with straight, sloping or Vee-shaped teeth, also bevel wheels, skew gear wheels, worm wheels and internal wheels. The machine head is carried on a pillar which is held in a base-plate bedded in the floor sand, and is made to slide on the pillar by means of a lever and link carried on a joint bearing, or by rack and pinion, or screw if thought advisable for the particular work it is being used for.

An adjustable stop collar is provided for accurately deciding the depth of mould. On the removable head a slide is carried for supporting the patterns of the teeth to be moulded. This slide is made adjustable by screw or pinion gearing to the diameter required. The number of teeth to be moulded is decided by a special dividing plate into which a steel wedge or finger engages. The special dividing plate has milled vees, at the angle of 60° inclusive, around its circumference, to receive the steel wedge, which is adjusted by a screw having an internal spring to keep it in tension and to lock the head when ramming operations are being carried out.

JAMES EVANS & CO., BRITANNIA WORKS,
(MANCHESTER), LIMITED,
BLACKFRIARS, MANCHESTER.

Trade Talk.

THE UNITED STEEL COMPANIES' rolling mills at Moss Bay, Workington, recommenced work on Monday.

F. THOMPSON LEGGE & COMPANY have removed to larger and more suitable premises at 43, Duke Street, Liverpool.

SAMUEL WARREN, LIMITED, Speedwell Steel Works, Sheffield, have appointed Dennis. Adams & Company as their London agents.

HOLLINGS & GUEST, LIMITED, of Birmingham, report that recent contracts include the installation of six hydraulic presses at the East India Railway locomotive works at Lucknow and Jamalpur.

DORMAN, LONG & COMPANY, LIMITED, have decided to blow in an additional blast furnace, and Bolckow, Vaughan & Company, Limited, are stated to be preparing to rekindle another furnace.

SCOTT BROS., of Keighley, report contracts for high-speed lathes, automatic gear-cutting machines and pillar drilling machines from the Admiralty, Crown Agents for the Colonies, and the Sudan Government.

SIR W. G. ARMSTRONG, WHITWORTH & COMPANY, LIMITED, have secured the contract from the Mersey Docks & Harbour Board for the construction and erection of the pair of 335-ton steel dock gates required for the inner passage of the Alfred Lock at Birkenhead.

THE DOMINION MACHINERY COMPANY, LIMITED, of Halifax, manufacturers of woodworking machinery, are introducing several new machines, including a combined chain and chisel mortiser, a sanding machine, and a saw bench and spindle moulder.

A CONTRACT FOR SEVERAL thousand steel sheaves required in connection with the erection of a large aerial ropeway now being built in Columbia, South America, has been secured by R. White & Sons, Widnes.

BROOM & WADE, LIMITED, manufacturers of air compressor plants, report that their works were on continuous overtime during 1925. The turnover for the year represented an increase of 30 per cent over 1924.

A STEEL BRIDGE is to be built to carry the Glasgow-Duntocher new arterial road over the London and North-Eastern Railway at Drumchapel. This work will be carried out by the Motherwell Bridge & Engineering Company, Limited.

THE BUENOS AIRES WESTERN RAILWAY have ordered 100 cattle wagons from the Birmingham Railway Carriage & Wagon Company, Limited, and the Great Western Railway have placed a contract for fifty fish vans with the Metropolitan Carriage, Wagon & Finance Company, Limited, Saltley.

THE METROPOLITAN CARRIAGE, WAGON & FINANCE COMPANY, LIMITED, have an order to supply the Egyptian State Railways with 1,000 open low-sided wagons of ten tons carrying capacity. Dorman, Long & Company, Limited, and Guest, Keen & Nettlefolds, Limited, have each been awarded contracts for the supply of 100,000 steel sleepers.

WILLIAM BEARDMORE & COMPANY, LIMITED, of Dalmuir, have received from Lage Irmaos, of Rio de Janeiro, orders for three passenger and cargo motor-ships. The vessels will each be about 400 ft. in length and of 5,000 tons gross, and they will be propelled by twin-screw, Beardmore-Tosi, internal combustion engines of the builders' make.

THE MOSS GEAR COMPANY, LIMITED, M. Petrovitch, Limited, Wright, Anderson & Company, Limited, Burt, Boulton & Haywood, Limited, John Elsworth & Sons, Limited, Quirk, Barton & Burns (St. Helens), Limited, Hobson, Houghton & Company, Limited, and the Laughton Leather Packing Company have joined the Federation of British Industries.

THE FEASIBILITY of using alloy and special steels in engineering was urged by Mr. A. P. Hague, chief metallurgist for Cammell, Laird & Company, Limited, in a lecture which he delivered before the Yorkshire Branch of the Institution of Mechanical Engineers at the Hotel Metropole, Leeds, on February 12. His subject was "The choice of steel for general engineering purposes."

BRITISH AUTOMATIC TURRET LATHES, having a greater production capacity than the best of similar American machines, are competing against the latter. A. Butterworth & Company, of Rochdale, report having secured a number of orders for these machines, and a further contract for six automatic screw machines in competition with the best American machines of similar type.

IN OUR LAST ISSUE we stated that King, Taudevin & Gregson, Limited, Cambridge Street, Sheffield, had acquired the business of Hinchliffe Brothers & Company, Townhall Chambers, Sheffield, who for many years had enjoyed a high reputation for the quality of fluor spar they had marketed. We are informed, however, that this is incorrect, inasmuch as King, Taudevin & Gregson, Limited, have not taken over the whole of the concern, but have acquired an interest in Hinchliffe Brothers & Company, Limited.

GEORGE RUSSELL & COMPANY, LIMITED, of Motherwell, have just received inquiries with regard to the repair and overhaul of two of their cranes, made respectively in 1871 and 1873, which have been in continuous use by the original purchasers since those dates.

A CONTRACT HAS BEEN placed with Ruston & Hornsby, Limited, by the Ashford Urban District Council for the supply of three vertical cold-starting oil engines of 600 B.H.P. These are required for the new electric power scheme which has been sanctioned by the Electricity Commissioners.

THE PROPRIETORS of the "Daily Mail" have decided to invite six working trade unionist engineers to visit the United States to investigate the question of high wages in that country, together with working conditions, hours, and the use of up-to-date machinery in representative American industrial establishments. The invited men include a fitter, turner, machineman, boiler-maker, moulder, and pattern-maker. The whole of the expenses attached to the visit will be paid by the "Daily Mail."

IN CONNECTION with the electrification scheme of the Bombay, Baroda and Central India Railway, Petters, Limited, of Yeovil, report the receipt of orders for their direct-coupled electric generation plants, comprising Petter "S" type oil engines and generators of Laurence Scott & Company's manufacture. This firm have also received orders for electric lighting plants and oil engines from Venezuela, and further orders for pumping installations for the Anglo-Persian Oil Company, Limited.

IT WILL BE OF INTEREST to Scottish readers to know that Wm. Jacks & Company, who have purchased the goodwill of the business of Wm. Jacks & Company, Limited, of Glasgow, etc., have taken on to their staff a number of the employés of the latter firm. One of these is Mr. Macfarlane, who for many years was secretary to the Scottish branch of the Institute of British Foundrymen, and he is continuing in his old position at 19, St. Vincent Place, where he may be found by his foundry friends.

AN INTERESTING COMPARISON of old and new methods is supplied by Thorn & Hoddle, Limited, 151, Victoria Street, S.W.1. They were called upon recently to employ their oxy-acetylene cutting process in cutting out and removing on site an old cast-iron flywheel 9 ft. in diameter, and weighing about 3 tons. The actual cutting operation took their mechanic two hours, whereas previous dismantling of a similar flywheel on the same site by the old "drill and smash" method had occupied a squad of men for two weeks.

COX & DANKS, LIMITED, have sent us details of their latest salvage success at Scapa Flow. The ex-German destroyer B.112 was raised on February 11, being the twenty-first salved to date. This is the third of the larger type of destroyers, weighing 1,300 tons, and is the first to be raised this year. The company hope to lift the four remaining large destroyers this year, together with the "Bremse" and the "Hindenburg." Cox & Danks, Limited, announce that, having completed the demolition of H.M.S. "Erin," H.M.S. "Orion," the 5,000 ton ex-German submarine testing dock, and the 40,000 ton ex-German floating dock, they will shortly be closing their Queenborough Ship-breaking Depot, and concentrating upon their salvage work at Scapa Flow. The shipbreaking plant, which is at present in operation at Queenborough, will, therefore, be sold. An announcement regarding the plant appears in our advertising pages.

Gazette.

A RECEIVING ORDER has been made in connection with the affairs of Mr. G. G. Onions, 3, New Street, Birmingham, metal broker.

MESSRS. W. H. ROBINSON and G. Wilcock, ingot brass manufacturers, South Street, Dewsbury, trading under the style of John Wilcock & Company, have dissolved partnership.

THE SHAREHOLDERS of the Tyseley Foundry, Limited, have decided to wind up the company voluntarily. Mr. C. E. Cowney, 55, Temple Row, Birmingham, has been appointed liquidator.

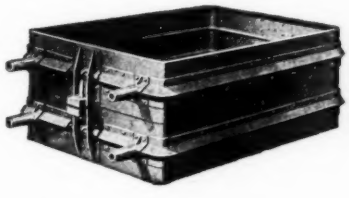
MR. J. SMITH, 36, Lincoln Street, Balsall Heath, Birmingham, brassfounder, lately carrying on business at 21, Milk Street, Birmingham, is paying a first and final dividend of 10s. in the £.

THE PARTNERSHIP heretofore subsisting between Messrs. C. Forrest, A. Sym, R. Sym and W. E. Gunthorpe, iron and brass founders and mechanical engineers, Philip's Park Road Foundry, Manchester, under the style of Forrest & Sym, has been dissolved.

Sterling BOXES

are specially designed for the rapid and efficient production of accurate castings.

Light in weight, easy to handle, rigid and durable



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Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.

STEEL MOULDERS' COMPOSITION, SILICA CEMENT.

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SIEMENS' STEEL PROCESS

BOILER, SHIP and BRIDGE PLATES, etc. ANGLES and all forms of Sectional Bars. TYRES and AXLES to all requirements. CASTINGS of all kinds and of Largest Sizes. FORGINGS of every description. BILLETS, BLOOMS, RAILS.

SPECIAL STEEL FOR CONSTRUCTIVE PURPOSES.

The STEEL COMPANY OF SCOTLAND, Ltd.

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Works: HALLSIDE, NEWTON and BLOCHAIRN, GLASGOW.

CONTRACTORS TO HOME, COLONIAL AND FOREIGN GOVERNMENTS.

Established 1872. *Telegraphic Address: "Steel, Glasgow."*

IRON AND STEEL MARKETS.

Pig-Iron.

MIDDLESBROUGH.—The rather slacker conditions recently noted in the Cleveland iron trade have undergone little material change during the current week, buying having been on a more restricted scale, due, doubtless, to heavy forward commitments covering the first quarter's requirements of consumers. It is true that there have been some inquiries for the second half of the year, and one or two sales of foundry iron are reported to have been made at a small premium above current quotations. But generally there is no disposition to buy ahead until the labour outlook becomes clearer. Meanwhile, supplies are scarce, and prompt lots are obtainable with difficulty and command full present rates. Quotations meanwhile are unchanged as follow: No. 1, 73s.; No. 3 G.M.B., 70s. 6d.; No. 4 foundry, 69s. 6d.; and No. 4 forge, 68s. 6d. per ton. These are export f.o.b. prices; home prices are 6d. per ton less.

While there is no particular change in the hematite position on Tees-side, business is certainly less active than it was earlier in the year, and here again the uncertainty of the coal outlook seems to be damping down fresh inquiry. This applies both to home and export trade. There is, however, very little iron available for the present month, but prices are slightly weaker. East Coast mixed numbers are at 77s. 6d., and No. 1 at 78s. per ton. On the North-West Coast prices are steady, with Bessemer mixed numbers £4 2s. 6d., c.i.f. Welsh ports; £4 5s. 6d. to £4 7s. 6d. per ton, delivered at Glasgow; £4 10s. per ton, delivered at Sheffield; and £4 14s. 6d. per ton, delivered at Birmingham.

THE MIDLANDS.—At Birmingham market last week the business passing in foundry pig was of moderate volume only, consumers of this quality iron having, as a rule, already made adjustments to satisfy more immediate needs, while demand for next quarter's supplies must be largely subject to labour conditions then obtaining. Local smelters are still talking of advanced prices, and certain Derbyshire furnaces are mentioning 70s. per ton, but very little business has been reported at this figure, as it is still possible to get a good Derbyshire No. 3 at 67s. 6d. to 68s. 6d. per ton. Ruling quotations are as follow: Derbyshire No. 3 foundry, 67s. 6d. to 68s. 6d.; Staffordshire No. 3 foundry, 67s. 6d. to 68s. 6d.; Northants No. 3 foundry, 64s. to 65s.

SCOTLAND.—Industrial conditions in this area show no improvement since last reported, and the attendances on 'Change have been very small. Founders find no inducement to buy anything more than their immediate requirements, which they can do easily on the basis of 76s. 6d. for No. 3 foundry, at furnaces. Recent contracts placed for steamers on the Clyde and district should of course result in a little business coming out, but with the Diesel engine the tonnage of pig-iron involved in construction is very much less than in the older type of motive power.

Finished Iron.

Manufacturers in the South Staffordshire area report a slight improvement in business conditions, there having been a better demand for crown iron, a fair volume of orders coming into the market, and the mills working more regularly. There is no alteration in the price, varying as it does from £11 to £11 10s. per ton, the former appearing to be the absolute minimum; in fact, at this price certain Staffordshire works are not prepared to compete. There has not been much support given during the last week or so to the makers of the cheap iron for nut and bolt and fencing work, who, of course, still have to face severe Continental competition.

Steel.

The majority of the steelworks producing sheet and tinplate bars are moderately well employed, but others would welcome further specifications. So far as the Welsh works are concerned very few are rolling billets, as the price is too unremunerative, but in other centres reports vary somewhat. The stiffening of the Continental quotation for semis seems undoubtedly to have helped British producers, and one hears fewer reports of £6 2s. 6d. having been cut. Even so, however, sellers would not run the risk of losing a desirable order by adhering too rigidly to the quotation. The tinplate market remains moderately steady, and the effect of the pooling scheme, which is now in operation, is not yet felt. No restriction of output has been made, and meantime prices are a shade easier in the absence of substantial business. Most works are now disposed to accept 19s. 3d., basis I.C., f.o.b. works port, and business has also been done at 1½d. per standard box below this figure.

Scrap.

Business in this class of material is variable in extent, demand for scrap metal in some markets being more or less dominated by local requirements, while the general trend of inquiry is far from active. In Scotland machinery cast-iron scrap is still quoted at 74s. to 75s. per ton, and for ordinary cast-iron scrap suitable for foundries and in pieces not exceeding 1 cwt. 68s. 6d. to 70s. per ton. Old cast-iron railway chairs are, if anything, a little better in demand now at 73s. 6d. to 75s. per ton. Light cast-iron scrap and firebars have improved, and there has been a fair inquiry. Good substantial parcels can command 60s. to 62s. per ton. The above prices are all per ton, delivered f.o.t. consumers' works. In the Midlands cast-iron scrap is still weak at 72s. 6d., delivered to local works, with a considerably better demand for light cast-iron metal at 62s. 6d. per ton delivered.

Metals.

Copper.—With a better all-round consumptive demand at home and abroad, the market for standard copper has partially regained its former strength, with a tendency to firmer values, both for prompt and forward metal. The decided change for the better in general market conditions, and the fact that American selling agencies are in a stronger position after the good sales they have effected lately, is rather calculated to stimulate further buying on European account, and already it is reported that Germany has been in the market for more important quantities. Current quotations:—*Cash*: Thursday, £59 5s.; Friday, £59 7s. 6d.; Monday, £59 10s.; Tuesday, £59 17s. 6d.; Wednesday, £59 12s. 6d.

Three Months: Thursday, £60 5s.; Friday, £60 7s. 6d.; Monday, £60 10s.; Tuesday, £60 16s. 3d.; Wednesday, £60 12s. 6d.

Tin.—Increased strength in values has been the dominant note in this section of the market recently, additional firmness having developed both on prompt and forward buying. The Continental demand has been more active, and consumers have covered their needs more freely. Prospects for the current month being also encouraging in anticipation of decreased shipments and the continuation of heavy American deliveries already placed at about 7,000 tons, there is little doubt that bull activities will be extended further. Current quotations:—*Cash*: Thursday, £289 15s.; Friday, £290 5s.; Monday, £291 10s.; Tuesday, £294 17s. 6d.; Wednesday, £293 5s.

Three Months: Thursday, £282 5s.; Friday, £282 5s.; Monday, £282 7s. 6d.; Tuesday, £283 15s.; Wednesday, £283 5s.

Spelter.—Home consumptive demand for this metal shows steady expansion, as according to official returns the apparent aggregate in the United Kingdom last year totalled at 177,020 tons, against 160,776 tons in 1924. It is reported that about 3,000 tons of zinc concentrates per month are moving out of the Couer D'Alene district of Idaho, being sent by rail to Portland and Seattle, and there transferred to ships going largely to Belgium. Current quotations:—*Ordinary*: Thursday, £36 3s. 9d.; Friday, £35 10s.; Monday, £35 12s. 6d.; Tuesday, £35 15s.; Wednesday, £35 15s.

Lead.—A trade authority writes: Arrivals are again taking place in large quantities, and the fall in European consumption is having the inevitable effect of bringing metal to London which cannot be disposed of elsewhere. The tonnage of lead in warehouse here continues, therefore, to grow, and this state of affairs has caused a contango to be established which will probably become wider if stocks increase still further. Current quotations:—*Soft foreign (prompt)*: Thursday, £33 15s.; Friday, £34; Monday, £33 17s. 6d.; Tuesday, £33 15s.; Wednesday, £33 15s.

That British foundry supplies are appreciated on the Continent of Europe is emphasised by a letter we have received from the Fordath Engineering Company, Limited, of West Bromwich, which after referring to the dispatch of a consignment of British pig-iron by air as noted by us in our last issue, points out that they, too, have had to utilise the air mail to meet urgent demands from Continental customers.

STEEL GRIT

ROUND AND ANGULAR

THE BEST AND MOST EFFICIENT MATERIAL FOR USE WITH SAND-BLAST MACHINERY IN CLEANING IRON, STEEL AND BRASS.

Samples and Prices on Application.

Wm. McGREGOR
SCOTTISH STEEL GRIT WORKS,
AIRDRIE——SCOTLAND.

Every time you sign a cheque for Crucibles——Think of the BRITISH REVERBERATORY FURNACE

NO CRUCIBLES.

CHEAPER FUEL.

LOW UPKEEP.

Suitable for Copper, Bronze, Aluminium, Ferro Manganese, Cast Iron & Reheating

SEND FOR OUR NEW CATALOGUE—

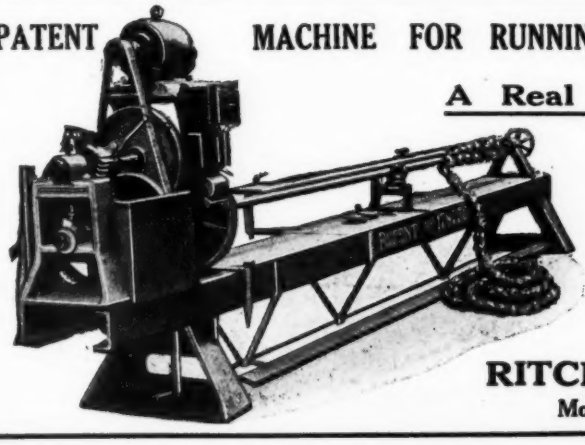
BRITISH REVERBERATORY FURNACES LTD.

Telephone: Victoria 6971. 82, VICTORIA STREET, LONDON, S.W.1.

MAKERS OF ALL INDUSTRIAL FURNACES.

PATENT MACHINE FOR RUNNING LOAM CORES ON BARRELS

A Real Labour Saver.



Cores any length and diameter, OPERATED BY ONE MAN. Driven by motor or countershaft. Machines in use for cores 28 ft. × 30 in. diameter. Patent No. 178750.

Testimonials from Iron and Brass Founders.

RITCHIE HART & CO., LTD.
Mount Pottinger Foundry, BELFAST.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	59	12	6
Three months	60	12	6
Electrolytic	66	10	0
Tough	63	0	0
Best selected	63	15	0
Sheets	90	0	0
India	75	0	0
Wire bars	67	0	0
Do. March	66	12	6
Do. April	66	12	6
Ingot bars	66	12	6
H.C. wire rods	71	0	0
Off. av. cash, Jan.	59	1	6
Do., 3 mths. Jan.	60	3	0
Do., Sttlmnt, Jan.	59	1	7½
Do., Electro, Jan.	65	11	4½
Do., B.S., Jan.	63	16	10½
Aver. spot price copper, Jan.	59	1	6
Do., wire bars, Jan.	65	16	3

Solid drawn tubes 13d.
Brazed tubes 13d.
Wire 10d.

BRASS.

Solid drawn tubes 12d.
Brazed tubes 13½d.
Rods, drawn 11½d.
Rods, extd. or rlld. 7½d.
Sheets to 10 w.g 10½d.
Wire 10½d.
Rolled metal 9½d.
Yellow metal rods 7½d.
Do. 4 × 4 Squares 8d.
Do. 4 × 3 Sheets 8½d.

TIN.

Standard cash	293	5	0
Three months	283	5	0
English	291	10	0
Bars	295	0	0
Straits	294	10	0
Australian	295	0	0
Eastern	287	0	0
Banca	294	10	0
Off.aver. cash, Jan.	282	3	3
Do., 3 mths., Jan.	276	4	4½
Do., Sttlmt. Jan.	282	3	0
Aver. spot., Jan.	282	3	0

SPELTER.

Ordinary	35	15	0
Remelted	35	0	0
Hard	30	0	0
Electro 99.9	38	17	6
English	36	7	6
India	31	15	0
Zinc dust	45	0	0
Zinc ashes	15	10	0
Off. aver., Jan.	37	14	2⅛
Aver., spot, Jan.	38	1	2¼

LEAD.

Soft foreign ppt.	33	15	0
English	35	5	0
Off. average, Jan.	34	13	7½
Average spot, Jan.	34	15	6¾

ZINC SHEETS, &c.

Zinc sheets, English	45	0	0
Do. V.M. ex whf.	42	0	0
Rods	49	0	0
Boiler plates	42	10	0
Battery plates	42	0	0

ANTIMONY.

Special brands, Eng.	99	0	0
Chinese	92	10	0
Crude	61	0	0

QUICKSILVER.

Quicksilver 14 15 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon
25% 9 17 6
45/50% 11 16 6
75% 21 2 6
Ferro-vanadium—
35/40% 14/- to 15/- lb. va.
Ferro-molybdenum—
70/75% c. free 6/- lb.
Ferro-titanium—
23/25% carbonless 1/- lb.
Ferro-phosphorus, 20/25%, £19 10 0
Ferro-tungsten—
80/85%,c.fr. 1/10 to 1/11 lb.
Tungsten metal powder—
98/99% 2/1 to 2/2 lb.
Ferro-chrome—
2/4% car. £33 0 0
4/6% car. £22 0 0
6/8% car. £21 17 6
8/10% car. £20 17 6
Ferro-chrome—
Max. 2% car. £39 15 0
Max. 1% car. £45 0 0
Max.0.70%car. £50 0 0
70%, carbonless 1/5½ lb.
Nickel—99%, cubes or pellets £172 to £175
Cobalt metal—98/99% 10/- to 11/- lb.
Aluminium 98/99% £118
Metallic Chromium—
96/98% 3/9 lb.
Ferro-manganese (net)—
76/80%, loose £15 7 6
76/80%, packed £16 7 6
76/80%, export £15 5 0
Metallic manganese—
94/96%, carbonless 2/- lb.
Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten s. d. 2 6
Finished bars, 18% tungsten 3 0
Per lb. net, d/d buyers' works.
Extras—
Rounds and squares 3 in. and over 4d.lb.
Rounds and squares under ½ in. to ¼ in. 3d. lb.
Do. under ¼in. to ⅛ in. 1/- lb.
Flats, ½in. × ¼in. to under 1 in. × ⅜ in. 3d. lb.
Do. under ½in. × ¼in. 1/- lb
Bevels of approved sizes and sections 6d. lb.
Bars cut to length 10% extra
Scrap from high-speed tool steel—
Scrap pieces 3d.
Turnings and swarf 1d.
Per lb. net, d/s steel makers' work

SCRAP.

	£	s.	d.	£	s.	d.
South Wales—						
Hvy. steel	3	8	6 to	3	10	0
Bundled steel & shrngs.	3	3	6 to	3	7	6
Mixed iron & steel	3	2	6 to	3	3	6
Heavy cast iron	3	3	6 to	3	6	6

Good machinery for foundries 3 7 6 to 3 10 0

Cleveland—			
Heavy steel	3	5	0
Steel turnings	2	5	6
Cast iron borings	2	5	0
Heavy forge	4	5	0
Bushelled scrap	3	10	0
Cast-iron scrap	3	4	6
Lancashire—			
Cast-iron scrap	3	12	9
Heavy wrought	3	7	6
Steel turnings	2	0	0

London — Merchants' buying prices delivered yard.

Copper (clean)	51	0	0
Brass (clean)	39	0	0
Lead (less usual draft)	31	0	0
Tea lead	27	0	0
Zinc	25	0	0
New aluminium cuttings	87	0	0
Braziery copper	46	0	0
Gunmetal	47	0	0
Hollow pewter	185	0	0
Shaped black pewter	140	0	0

PIG-IRON.

(*f.o.t. unless otherwise stated*).

N.E. Coast—	
Foundry No. 1	72/6
Foundry No. 3	70/-
Foundry No. 4	69/-
Forge No. 4	68/-
Hematite No. 1	78/-
Hematite M/Nos.	77/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	86/6
,, d/d Birm.	94/6
Midlands—	
Staffs common*	—
,, No. 4 forge	62/6
,, No. 3 foundry	68/-
Shrops. basic	70/-
,, Cold blast, ord.*	185/-
,, ,, roll iron*	190/-
* d/d Birmingham.	
Northants forge	57/6
,, fdry No. 3	64/6
Derbyshire forge	62/6
,, fdry. No. 3	68/-
,, basic	65/-
Scotland—	
Foundry No. 1	81/6
,, No. 3	76/6
Hem. M/Nos.	76/6
Sheffield (d/d district)—	
Derby forge	66/6
,, fdry. No. 3	72/-
Lincs. forge	67/6
,, fdry. No. 3	70/-
E.C. hematite	88/-
W.C. hematite	90/-
Lincs. (at furnaces)—	
Forge No. 4	61/6
Foundry No. 3	64/-
Basic	64/-
Lancashire (d/d eq. Man.)—	
Derby forge	70/-
,, fdry. No. 3	75/-
Northants foundry No. 3	77/3
Dalzell, No. 3	110/-
Summerlee, No. 3	94/-
Glengarnock, No. 3	94/-
Gartsherrie, No. 3	94/-
Monkland No. 3	94/-
Coltness, No. 3	94/-
Shotts, No. 3	94/-

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars(cr.)	11	5	0 to	12	10	0
Angles				11	10	0
Tees to 3 united ins.				12	0	0
Nut and bolt				10	15	0
Hoops	14	0	0 to	15	0	0
Marked bars (Staffs.) f.o.t.				14	0	0
Gas strip	12	10	0 to	12	15	0
Bolts and nuts ⅜ in. × 4 in.				16	15	0
Steel—						
Ship plates	7	7	6 to	7	17	6
Boiler plts.				11	10	0
Chequer plts.	£9	5	to	9	15	0
Angles	£7	0	0 to	7	5	0
Tees	£8	0	0 to	8	5	0
Channels	£6	12	6 to	7	2	6
Joists	£7	0	0 to	7	5	0
Rounds and Squares 3 in. to 5½ ins.				8	0	0
Rounds under 3 in. to ⅜ in.				7	15	0
Flats, over 5 in. wide and up				8	10	0
Flats, 5in. to 1½in.				7	10	0
Rails, heavy				8	0	0
Fishplates				12	0	0
Hoops (Staffs.)				10	10	0
Black sheets, 24g.				11	5	0
Galv. cor. sheets, 24g.				16	2	6
Galv. fencing wire 8g. plain				14	0	0
Billets, soft	£6	0	0 to	6	2	6
Billets, hard				8	2	6
Sheet bars	6	2	6 to	6	5	0
Tin bars d/d	6	2	6 to	6	5	0

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	3
Sheet to w.g.	1	3½
Wire	1	3½
Rods	1	3
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
3/0 to 10 G.	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.	Dols.
No. 2X foundry, Phila.	24.26
No. 2 foundry, Valley	22.26
No. 2 foundry, Birm.	22.00
Basic	21.76
Bessemer	22.76
Malleable	22.26
Grey forge	21.76
Ferro-mang. 80% d/d	115.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	35.00
O.-h. billets	35.00
O.-h. sheet bars	36.00
Wire rods	45.00
	Cents.
Iron bars, Phila.	2.22
Steel bars	2.00
Tank plates	1.80
Beams, etc.	1.90
Skelp, grooved steel	1.90
Skelp, sheared steel	1.90
Steel hoops	2.50
Sheets, black, No. 28	3.25
Sheets, galv., No. 28	4.50
Sheets, blue an'l'd, 9 & 10	2.50
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv.	3.35
Tinplate, 100 lb. box	$5.50

COKE (at ovens).

Welsh foundry 32/6 to 37/6
,, furnace 20/- to 25/-
Durham & North.
,, foundry 30/- to 33/-
,, furnace 16/- to 17/-
Other Districts, foundry 30/- to 33/-
,, ,, furnace (basis) 11/9

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes,	20×14, box	19/3
,,	28×20, ,,	38/9
,,	20×10, ,,	29/1½
,,	18¾×14, ,,	20/4½
C.W.	20×14, ,,	17/7½
,,	28×20, ,,	35/3
,,	20×10, ,,	24/4½
,,	18¾×14, ,,	18/4½

Terneplates 28×20, 35/7½ per box basis f.o.b.

SWEDISH IRON.

Bars, hammered £18/10 to £19/0
Rolled Ord. £16/0/0 to £16/10/0
Nail rods £16 5 0 to £16 15 0
Keg. steel nom. £33 to £35
Faggot steel nom. £22 to £25
Blooms, according to quality £9 to £12
Pig-iron £6 15 0 to £7 0 0 all f.o.b. Gothenburg.

TUBES AND FITTINGS.
Up to and incl. 6 in.

	Tubes	*Fittings*
Gas	60%	50%
Water	55%	45%
Steam	50%	40%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

	£	s.	d.		
Feb. 18	59	5	0	dec.	12/6
,, 19	59	7	6	inc.	2/6
,, 22	59	10	0	,,	2/6
,, 23	59	17	6	,,	7/6
,, 24	59	12	6	dec.	5/-

Electrolytic Copper.

	£	s.	d.		
Feb. 18	66	10	0	No change	
,, 19	66	10	0	,,	,,
,, 22	66	10	0	,,	,,
,, 23	66	10	0	,,	,,
,, 24	66	10	0	,,	,,

Standard Tin (Cash).

	£	s.	d.		
Feb. 18	289	15	0	inc.	40/-
,, 19	290	5	0	,,	10/-
,, 22	291	10	0	,,	25/-
,, 23	294	7	6	,,	57/6
,, 24	293	5	0	dec.	22/6

Tin (English ingots).

	£	s.	d.		
Feb. 18	288	10	0	inc	40/-
,, 19	289	15	0	,,	25/-
,, 22	290	10	0	,,	15/-
,, 23	293	0	0	,,	50/-
,, 24	291	10	0	dec.	30/-

Zinc Sheets (English).

	£	s.	d.		
Feb. 18	45	0	0	No change	
,, 19	45	0	0	,,	,,
,, 22	45	0	0	,,	,,
,, 23	45	0	0	,,	,,
,, 24	45	0	0	,,	,,

Spelter (ordinary).

	£	s.	d.		
Feb. 18	35	3	9	dec.	12/6
,, 19	35	10	0	inc.	6/3
,, 22	35	12	6	,,	2/6
,, 23	35	15	0	,,	2/6
,, 24	35	15	0	No change	

Lead (English).

	£	s.	d.		
Feb. 18	35	0	0	dec.	10/-
,, 19	35	5	0	inc.	5/-
,, 22	35	5	0	No change	
,, 23	35	5	0	,,	,,
,, 24	35	5	0	,,	,,

AVERAGE PRICES OF STEEL RAILS.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1908	6 2 6	6 0 0	6 0 6	5 15 6	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 10 0	5 16 3
1909	5 5 0	5 5 0	5 5 0	5 0 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0
1910	5 5 0	5 7 6	5 7 6	5 7 6	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 8 11½
1911	5 15 0	5 15 0	5 15 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 13 1½
1912	5 13 1	5 15 0	5 15 0	5 15 7	6 1 6	6 6 3	6 7 6	6 8 0	6 11 3	6 12 6	6 12 6	6 13 9	6 4 4
1913	6 15 0	6 14 4½	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 10 0	6 10 0	6 10 0	6 10 0	6 12 0
1914	6 10 0	6 10 0	6 6 3	6 0 0	6 0 0	6 0 0	5 14 0	6 2 6	6 13 9	6 12 0	6 7 6	6 7 6	6 5 3½
1915	6 10 6	6 17 6	7 5 0	7 12 6	7 12 6	7 17 6	8 17 6	9 2 6	9 2 6	9 2 6	9 7 6	10 10 6	8 6 6½
1916	10 19 4	11 0 0	11 0 0	10 18 9	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 9 10
1917	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6
1918	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6
1919	10 17 6	13 7 6	13 7 6	13 7 6	15 0 0	15 10 0	16 0 0	16 10 0	16 10 0	16 10 0	16 10 0	17 5 0	14 12 11
1920	18 15 0	19 5 0	20 7 6	22 0 0	23 0 0	23 0 0	24 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	22 18 11½
1921	23 5 0	20 4 0	18 0 0	17 0 0	15 0 0	15 0 0	14 0 0	14 0 0	14 0 0	11 12 6	10 10 0	10 0 0	15 4 3
1922	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 0 0	8 15 0	8 15 0	8 15 0	8 15 0	9 4 2
1923	8 17 6	9 2 0	10 5 0	10 10 0	10 10 0	10 10 0	9 15 0	9 0 0	8 15 0	8 15 0	8 19 0	9 5 0	9 9 10
1924	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 2 6	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 2 3½
1925	9 0 0	9 0 0	9 0 0	9 0 0	8 15 0	8 10 7½	8 10 0	8 10 0	8 10 0	8 4 0	8 0 0	8 0 0	8 11 7½
1926	8 0 0	—	—	—	—	—	—	—	—	—	—	—	—

AVERAGE MONTHLY PRICES OF EAST COAST HEMATITE AT MIDDLESBROUGH.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1915	83 11	88 6	94 8	107 0	102 6	101 3	98 9	98 7½	96 6	104 0	124 1	130 0	106 11½
1916	133 9	140 0	136 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	128 1½
1917	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6
1918	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6
1919	122 6	122 6	122 6	122 6	179 2	190 0	197 6	200 0	200 0	200 0	200 0	200 0	171 4
1920	220 0	220 0	240 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	251 8
1921	240 0	220 0	180 0	180 0	180 0	160 0	160 0	160 0	137 0	127 6	117 6	104 6	162 2
1922	97 6	91 7½	100 0	98 6	97 1½	94 7	93 6	90 9	89 7	91 10½	93 0	93 2	94 5½
1923	94 6	104 9	122 0	126 10½	122 0	115 3	107 0	98 8½	98 10½	99 1½	100 6½	102 3	107 10½
1924	102 4½	101 3	99 7½	99 0	98 9½	97 4½	95 3½	93 1½	90 7½	88 0	88 4½	88 6	95 2½
1925	87 5	85 9	84 7½	82 6	80 10½	79 3	77 1½	75 7½	75 0	74 3½	74 9	76 0	79 5½
1926	77 3	—	—	—	—	—	—	—	—	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

18, BENNETTS HILL, BIRMINGHAM.
11, OLD HALL STREET, LIVERPOOL.
EXCHANGE BLDGS., PORT TALBOT.
FOWLERS BUILDINGS, BOMBAY.
CLIVE STREET, CALCUTTA.
ANGAPPA NAICK STREET, MADRAS.

REGISTERED TRADE MARK
LIMPET

1, HONG KONG ROAD, SHANGHAI.
OCEAN BUILDING, SINGAPORE.
JAVA STREET, KUALA LUMPUR
5, SHAFFRAZ ROAD, RANGOON.
COX'S BUILDINGS, KARACHI.
P.O. BOX 1580, CAIRO.

PIG IRON

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.,

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE

WILLIAM JACKS & COMPANY,

93, HOPE STREET, GLASGOW.

ROYAL EXCHANGE, MIDDLESBROUGH.

SITUATIONS VACANT AND WANTED.

FOREMAN ROLL CASTER, disengaged, desires post; experienced in all classes chilled and grain work and able to fully control furnaces and charges; age 38.—Box 630, Offices of THE FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

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AUCTION SALE.

By Order of the Receiver, J. STEPHENSON, ESQ., O.B.E., F.S.A.A., BURTON ROAD, STAR ROAD, PETERBOROUGH.

HENRY BUTCHER & COMPANY

Will SELL by AUCTION (unless previously disposed of), on the PREMISES, on WEDNESDAY, 10th MARCH, 1926, at Eleven a.m.,

THE FREEHOLD FOUNDRY,

PLANT, MACHINERY and STOCK
of the
REGAL CASTINGS COMPANY,
comprising :—

LAND and BUILDINGS, site area about ¾ acre. Floor space about 14,200 sq. ft.
FOUNDRY PLANT, including CUPOLAS, FOUNDRY BOXES, LADLES, etc.
26 h.p. DIESEL ENGINE.

S.S. and S.C. Lathes, Milling Machines, Drilling Machines, Shaping Machines, etc.

STOCK of RAIN-WATER PIPES, SOIL PIPES, and HALF-ROUND and O.G. GUTTERS, FITTINGS, MANHOLES, etc., PATTERNS and CORE BOXES.

Office Furniture, Desks, Safes, Typewriters, Time Recorders, etc., and
THE GOODWILL OF THE BUSINESS.

ON VIEW the week preceding the Sale, or by appointment.

Particulars and Catalogues from Messrs. Stephenson, Smart & Company, Incorporated Accountants, 78, Old Broad Street, E.C.2, and at Queen Street Chambers, Peterborough, or Messrs. Henry Butcher & Company, Auctioneers, Valuers and Surveyors, 63 and 64, Chancery Lane, W.C.2.

MACHINERY

"OLIVER" No. 75 Mechanical Pattern Maker and Universal Wood Milling Machine, with ball bearings; had little use; equal to new; full set tools, accessories, etc.; very low price; photo, full particulars.—FRED BROWN & SON, LIMITED, North Road Works, St. Helens.

ALLDAY'S GAS-FIRED CORE STOVE, 4 ft. x 3 ft. 6 in. x 6 ft.; Sand Mixer, 30 in.; Rumbler, 3 ft. 6 in.; Sand Mill, Moulding Boxes, Hand Ladles, etc.; never been used. What offers?—VIPAN & HEADLY, Abbey Gate, Leicester.

SMALL CUPOLA, 18 ft. high, with ball-bearing Blast Fan and Piping, in excellent order, £20.—GIRLINGS, Maldon, Essex.

SAND MIXERS.—New and second-hand. Ask us to quote.—W. BREALEY & COMPANY, LIMITED, Prospect Works, Hawksley Avenue, Sheffield.

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14-in. stroke DOUBLE-HEADED SHAPING MACHINE, traversing heads, bed 10 ft. long, two box tables, by Butler.

Nearly New Model S.D. "BECKER" VERTICAL MILLING MACHINE, continuous type, all-geared head.

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READING

July 6th to 10th, 1926.

EXHIBITION OF IMPLEMENTS, &c.

The Regulations and Forms of Application for Space are now ready.

Applications must be made by

SATURDAY, MARCH 20, 1926

Live Stock entries close on MAY 1st; Produce and Forestry on MAY 20th; Horticulture on MAY 26th; Poultry on MAY 31st; Competitions for Plantations, Home Nurseries, Orchards and Fruit Plantations on May 1st.

T. B. TURNER, Secretary.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND,
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54" CUPOLA, by THWAITES, 6 tons per hour, drop bottom spark arrester, all pipes and valves, just as new, been very little used, a bargain £100

48" CUPOLA, by THWAITES, as above, but no spark arrester £70

30" CUPOLETTE, by CONSTRUCTIONAL CO., with pipes and fan complete... ... ... £32

NEW LADLES—CHEAP.

12 Ton EVANS	£95
5 Ton McNEIL, enclosed gear	£38
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2½ Ton by GEORGE GREEN	£30
2 Ton THWAITES	£26
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